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VACCINATION COMMISSION.

FINAL REPORT

OF THE

ROYAL COMMISSION

APPOINTED TO INQUIRE INTO THE SUBJECT OF

VACCINATION.

Presented to both Houses of Parliament by Command of Her Majesty.

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ROYAL COMMISSIONS.

I.

VICTORIA R.

Victoria, by the Grace of God of the United Kingdom of Great Britain and Ireland Queen, Defender of the Faith,

To Our right trusty and well-beloved Councillor, Farrer, Baron Herschell, Our trusty and well-beloved: Sir James Paget, Baronet, Fellow of the Royal College of Surgeons, Sir Charles Dalrymple, Baronet, Sir William Guyer Hunter, Knight Commander of Our Most Distinguished Order of Saint Michael and St. George, Fellow of the Royal College of Physicians, Sir Edwin Henry Galsworthy, Knight, William Scovell Savory, Esquire, President of the Royal College of Surgeons, Charles Bradlaugh, Esquire, John Syer Bristowe, Esquire, Fellow of the Royal College of Physicians, William Job Collins, Esquire, Fellow of the Royal College of Surgeons, John Stratford Dugdale, Esquire, one of Our Counsel learned in the Law, Michael Foster, Esquire, Master of Arts, Professor of Physiology in Our University of Cambridge, Jonathan Hutchinson, Esquire, Fellow of the Royal College of Surgeons, James Allanson Picton, Esquire, Samuel Whitbread, Esquire, and Frederick Meadows White, Esquire, one of Our Counsel learned in the Law, greeting!

Whereas We have deemed it expedient that a Commission should forthwith issue to inquire and report as to—

(1.) The effect of vaccination in reducing the prevalence of, and mortality from, small-pox.

(2.) What means, other than vaccination, can be used for diminishing the prevalence of small-pox; and how far such means could be relied on in place of vaccination.

(3.) The objections made to vaccination on the ground of injurious effects alleged to result therefrom; and the nature and extent of any injurious effects which do, in fact, so result.

(4.) Whether any, and, if so, what means should be adopted for preventing or lessening the ill effects, if any, resulting from vaccination; and whether, and, if so, by what means, vaccination with animal vaccine should be further facilitated as a part of public vaccination.

(5.) Whether any alterations should be made in the arrangements and proceedings for securing the performance of vaccination, and, in particular, in the provisions of the Vaccination Acts with respect to prosecutions for non-compliance with the Law.

Now know ye, that We, reposing great trust and confidence in your knowledge and ability, have authorised and appointed, and do by these presents authorise and appoint, you, the said Farrer, Baron Herschell; Sir James Paget; Sir Charles Dalrymple; Sir William Guyer Hunter; Sir Edwin Henry Galsworthy; William Scovell Savory; Charles Bradlaugh; John Syer Bristowe; William Job Collins; John Stratford Dugdale; Michael Foster; Jonathan Hutchinson; James Allanson Picton; Samuel Whitbread; and Frederick Meadows White; to be Our Commissioners for the purposes of the said inquiry.

And for the better effecting the purposes of this Our Commission We do by these presents give and grant unto you, or any five or more of you, full power to call before you such persons as you shall judge likely to afford you any information upon the subject of this Our Commission; and also to call for, have access to, and examine all such books, documents, registers, and records as may afford you the fullest information on the subject; and to inquire of and concerning the premises by all other lawful ways and means whatsoever.

And We do further by these presents authorise and empower you, or any five or more of you, to visit and personally inspect such places as you may deem expedient for the more effectual carrying out of the purposes aforesaid.

And We do by these presents will and ordain that this Our Commission shall continue in full force and virtue; and that you, Our said Commissioners, or any five or more of you, may, from time to time, proceed in the execution thereof, and of every matter and thing therein contained, although the same be not continued from time to time by adjournment.

And We do further ordain that you, or any five or more of you, have liberty to report your proceedings under this Our Commission from time to time, if you shall judge it expedient so to do.

And Our further Will and Pleasure is that you do with as little delay as possible report to Us, under your hands and seals, or under the hands and seals of any five or more of you, your opinion upon the several matters herein submitted for your consideration.

Given at Our Court at Saint James's the Twenty-ninth day of May one thousand eight hundred and eighty-nine; in the Fifty-second year of Our Reign.

By Her Majesty's Command.

HENRY MATTHEWS.

II.

VICTORIA R.

Victoria, by the Grace of God, of the United Kingdom of Great Britain and Ireland Queen, Defender of the Faith, To Our trusty and well-beloved John Albert Bright, Esquire, greeting!

Whereas We did, by Warrant under Our Royal Sign Manual, bearing date the twenty-ninth day of May, One thousand eight hundred and eighty-nine, appoint Our right trusty and well-beloved Councillor, Farrer, Baron Herschell, together with the several gentlemen therein respectively mentioned, or any five or more of them, to be Our Commissioners to inquire and report as to—

(1.) The effect of vaccination in reducing the prevalence of, and mortality from, small-pox.

(2.) What means, other than vaccination, can be used for diminishing the prevalence of small-pox; and how far such means could be relied on in place of vaccination.

(3.) The objections made to vaccination on the ground of injurious effects alleged to result therefrom; and the nature and extent of any injurious effects which do, in fact, so result.

(4.) Whether any, and, if so, what means should be adopted for preventing or lessening the ill effects, if any, resulting from vaccination; and, whether, and, if so, by what means, vaccination with animal vaccine should be further facilitated as a part of public vaccination.

(5.) Whether any alterations should be made in the arrangements and proceedings for securing the performance of vaccination, and, in particular, in the provisions of the Vaccination Acts with respect to prosecutions for non-compliance with the Law.

And whereas one of Our Commissioners so appointed, namely, Charles Bradlaugh, Esquire, has since deceased:

Now know Ye that We, reposing great confidence in you, do by these Presents appoint you, the said John Albert Bright, to be one of Our Commissioners for the purpose aforesaid in the room of the said Charles Bradlaugh, deceased, in addition to and together with the other Commissioners whom We have already appointed.

Given at Our Court at Saint James's the Eighth day of April one thousand eight hundred and ninety-one; in the Fifty-fourth year of Our Reign.

By Her Majesty's Command.

HENRY MATTHEWS.

LIST OF APPENDICES TO THE COMMISSION'S FINAL REPORT.

I.—Detailed discussion by the Commission of:—

(A.) The "Variolous Test" (*on pages* 143–145 *of this volume*); and

(B.) Woodville's cases (*on pages* 145–153 *of this volume*).

II.—Tables, furnished by the Registrar-General, showing for England and Wales:—

(A.) The deaths from small-pox at certain age-periods, to one thousand deaths from small-pox at all ages, in each year 1848–1894 (*on page* 154 *of this volume*); and

(B.) The death-rates from small-pox, per million living at certain age-periods, in each year 1848–1894 (*on page* 155 *of this volume*).

III.—Report to the Commission of Dr. Sidney Coupland on the outbreak of small-pox in the Dewsbury Union in 1891–2. (*In a separate volume.*)

IV.—Report to the Commission of Dr. Arthur Pearson Luff on outbreaks of small-pox in London in 1892–3. (*In a separate volume.*)

V.—Report to the Commission of Dr. Thomas Dixon Savill on the outbreak of small-pox in the Borough of Warrington in 1892–3. (*In a separate volume.*)

VI.—Report to the Commission of Dr. Sidney Coupland on the outbreak of small-pox in the Borough of Leicester in 1892–3. (*In a separate volume.*)

VII.—Report to the Commission of Dr. Sidney Coupland on the outbreak of small-pox in the City of Gloucester in 1895–6. (*In a separate volume.*)

VIII.—Reports to the Commission of Dr. Sidney Coupland on the prevalence of small-pox in Glasgow, Liverpool, Salford, Manchester, Oldham, Chadderton, Leeds, Sheffield, Halifax and Bradford in 1892–3, and the measures adopted by the local authorities. (*In a separate volume.*)

IX.—Papers relating to cases in which death or non-fatal injury has been alleged or suggested to have been caused by, or otherwise connected with, vaccination. (*In a separate volume.*)

(A.) An analysis, prepared for the Commission by Dr. Sidney Coupland and Dr. Theodore Dyke Acland, of the reports made by Medical Inspectors of the Local Government Board on two hundred and five cases in which death, occurring on or between the 1st November 1888 and the 30th November 1891, had been alleged or suggested to have been connected with vaccination.

(B.) Memorandum, prepared by Dr. Edward Ballard and forwarded to the Commission by the Local Government Board, on the two hundred and five cases in which death, occurring on or between 1st November 1888 and the 30th November 1891, had been alleged or suggested to have been connected with vaccination, and which had been reported on by Medical Inspectors of the Local Government Board.

(C.) Reports on inquiries, made on behalf of the Commission, into cases in which death or non-fatal injury had been alleged or suggested to have been caused by, or otherwise connected with, vaccination; with other information as to certain cases, brought to the Commission's knowledge with a view to their investigation, into the circumstances of which inquiry was not made by medical men on behalf of the Commission.

FINAL REPORT.

TO THE QUEEN'S MOST EXCELLENT MAJESTY.

May it please Your Majesty,

We, the undersigned Commissioners appointed to inquire into the subject of vaccination, desire humbly to submit to Your Majesty our Final Report.

2. In the First Report which we submitted to Your Majesty we indicated the method we proposed to adopt in pursuing the investigation committed to us. In a later Report we recommended certain changes in the law, upon the expediency of which all the members of the Commission were agreed, whatever the conclusion to which they might ultimately be led on the specific questions on which they were required to report. As no steps have been taken to give effect to these recommendations, we shall have to advert to the matter again hereafter.

3. Our inquiry has been a prolonged one. We would gladly have concluded our labours at an earlier date; but we thought it desirable to give full scope to the evidence of those who were opposed to vaccination, as well as those who favoured the practice, in order that, whatever the value of the opinions we expressed, they should at least be the fruit of an exhaustive inquiry. Moreover, a thorough and systematic investigation of certain local epidemics necessarily involved much expenditure of time, and it would not have been possible for us to arrive at a satisfactory conclusion as to the risk attending vaccination unless our examination of cases of alleged injury had extended over a considerable period.

4. We have held 136 meetings for the examination of witnesses, and have examined 187 witnesses. In addition to this, we have caused important investigations to be conducted for our assistance.

5. On the eighteenth occasion on which we met, we were invited to make a personal examination of two children who were alleged to have suffered from the effects of vaccination. Some of the members of the Commission, at the request of their colleagues, made the desired examination. It was felt, however, that it would be neither practicable nor expedient to pursue the same course in other cases in which injury from vaccination was alleged. Authority was accordingly obtained from the Treasury to secure the services of competent observers to make such investigations as might be called for. A large number of cases of alleged injury from vaccination brought to the notice of the Commission have thus been the subject of careful investigation.

6. In addition to an examination of cases of this nature, it seemed expedient that a complete and systematic inquiry should be made into the circumstances connected with important local epidemics of small-pox which occurred from time to time, with a view especially to see what light they threw on the question of the protective effect of vaccination. Inquiries were therefore instituted as regards local outbreaks in the Dewsbury Union in 1891–2, in London, in Warrington, and in Leicester, in 1892–3, and in Gloucester in 1895–6.

7. As regards other local outbreaks of small-pox, which occurred in Glasgow, in Liverpool, in Salford and Manchester, in Oldham and Chadderton, in Leeds, in Sheffield, in Halifax, and in Bradford, during the years 1892–3, more limited inquiries were instituted to ascertain the extent and character of the various outbreaks and the steps taken by the local authorities to deal with them.

8. The examination of cases of alleged injury from vaccination was made by Dr. Thomas Barlow, Dr. Theodore Dyke Acland, Dr. Sidney Coupland, Dr. Arthur Pearson Luff, and Dr. Thomas Dixon Savill; the local outbreaks of small-pox were reported on by Dr. Coupland, Dr. Luff, and Dr. Savill. We desire to record our sense of the value of the services which these gentlemen have rendered.

(*A.*) *As to the effect of vaccination in reducing the prevalence of, and mortality from, small-pox.*

9. The first of the questions submitted to us by Your Majesty is as to "the effect "of vaccination in reducing the prevalence of, and mortality from, small-pox." This is obviously a fundamental question. It has been strenuously maintained by some that vaccination has not had, and, indeed, could not have had, any effect in controlling the spread of small-pox or in diminishing its virulence. They insist that the notion that it is, to any extent, a protection against small-pox rests on no scientific basis, that there is no relation between vaccinia and variola, and therefore no reason why those who have been subjected to vaccination should enjoy any immunity from, or protection against, small-pox. They insist, further, that as a matter of experience it is not proved that any such protection or immunity has been enjoyed by the vaccinated. The latter is manifestly the more important point. If the facts which have been accumulated, when fairly and impartially viewed, do really show that the vaccinated are either less liable to be attacked by small-pox, or if attacked suffer less severely, than the unvaccinated, any theory which rests on the basis that there is no possible connexion between vaccination and susceptibility to small-pox must evidently be regarded with distrust. If the protective effect of vaccination be thus established, then even if the relation of vaccinia to small-pox could not be explained, nor the reason why or the manner in which it affects human susceptibility to small-pox contagion, elucidated, it would still be quite reasonable to accept and act upon the conclusions to which experience directed us. The reason why the introduction of a particular drug into the human body produces certain phenomena may be incapable of explanation, but that it operates to produce these phenomena may be none the less certain. If, then, it be shown that vaccination has a protective influence against small-pox, or modifies the character of the disease, it is not necessary for the purpose of the inquiry upon which we are engaged to determine what is the true theory by which the effect is to be accounted for. To embark on such a scientific inquiry in any detail would be beyond the scope of our functions. If, again, experience does not warrant the assertion that vaccination tends to prevent the spread or mitigate the effects of small-pox, it is obviously immaterial whether this was *à priori* to be expected. At the same time, as it has been asserted with much confidence that science forbids a belief in the protective influence of vaccination, we have not thought it right to abstain altogether from dealing with this question. We shall, however, for the reasons we have given, discuss it much less in detail than the question what inferences ought to be drawn from the facts accumulated by the history of vaccination and small-pox in the period, now nearly a century, during which vaccination has been in use.

10. There was at the close of the eighteenth century, if not earlier, in districts where cow-pox had appeared, a belief among the dairy folk that those who had taken the cow-pox never took the small-pox; and indeed one Jesty, a Dorsetshire farmer, had in 1774, in the case of his wife and sons, purposely introduced the matter of cow-pox into the human subject with the view of protecting from small-pox.

The introduction and rapid spread of the practice of vaccination.

11. The practice, however, of inoculating with the matter of cow-pox, or vaccination as it was subsequently called, may be considered as dating from the publication of the "Inquiry into the Causes and Effects of the Variolæ Vaccinæ" of Edward Jenner, published in the summer of the year 1798. The practice rapidly spread, and prevailed widely in this country and other parts of western Europe during the first quarter of the present century. It was, beyond all question, so adopted in the genuine belief that it afforded protection against small-pox. Two questions at once present themselves. First, upon what was this belief founded; and, secondly, does the history of small-pox mortality from the time when the practice of vaccination became prevalent, support the view that it has such a protective influence?

Upon what was belief in the practice then founded?

12. Vaccinia or cow-pox is a disease affecting milch cows and marked by an eruption on the udder and teats. The disease can be communicated from the cow to man. Dairymen and maids engaged in milking cows affected with cow-pox are apt to have sores of a special kind on their hands or elsewhere, the development of the sores being frequently accompanied by febrile symptoms. There can be no doubt that, in a certain number of cases at all events, such sores are the local manifestations of cow-pox; the virus from the eruption on the cow being introduced

into some scratch or other imperfection in the skin of the milker and there producing its local effects, accompanied more or less by general symptoms.

13. In the treatise to which reference has been made Jenner records in the first place a number (19) of cases in which a person who had accidentally taken cow-pox from the cow, had never had small-pox and appeared incapable of taking that disease; the insusceptibility being shown on the one hand by the failure to contract the disease after ample exposure to contagion, such as nursing and attending to or even sleeping with persons suffering from small-pox, and on the other hand by the fact that when the person in question was inoculated with the matter of small-pox in the manner then usual (the matter being tested as to its efficiency on susceptible persons) the inoculation failed to excite small-pox. In the course of the inoculation practice it had been observed that when the operation was performed upon a person who had already had small-pox, either naturally or by inoculation, the wound of inoculation, instead of developing as it did when the operation was successful in a person who had not had the small-pox, into a vesicle and so into a pustule with the variolous characters (the development being accompanied by febrile symptoms and, save in exceptional cases, by the appearance of a smaller or greater number of variolous pustules on parts of the skin other than the seat of inoculation), presented as a rule nothing more than some slight inflammation, dying away in a few days without any other symptom, or even healed at once without any symptoms at all, local or general; and in the exceptional cases in which further changes took place in the wound, these were not accompanied or followed by an eruption of pustules or even by the febrile and other general symptoms of small-pox. Accordingly, in cases of small-pox inoculation where it was doubtful whether the disease had been communicated, it had become not an uncommon practice to repeat the operation, in order to judge by the effects produced whether the earlier inoculation had or had not produced the disease; and the practice, thus originating in connexion with small-pox inoculation, had come to be spoken of as the "variolous "test." We discuss the "variolous test" in greater detail in an appendix on pages 143–5.

14. In his treatise Jenner distinguishes between what he calls true cow-pox and other eruptions which he speaks of as spurious, and which he regarded as not affording protection against small-pox, although he gives no details to show that the cases quoted by him as affording protection were cases of his true cow-pox. He also developed the view that matter derived from horses suffering from the disease known as the grease is capable of giving rise to cow-pox in the cow, and indeed is the real origin of the true disease. It will be desirable to consider the questions relating to the grease of horses later on. It may be added that Jenner also expressed the opinion that the protection thus afforded by cow-pox was permanent in character.

15. Jenner further recorded in the same treatise how he had in 1796 inoculated a healthy boy of eight years of age in the arm with cow-pox matter taken from a sore on the hand of a dairymaid who had been infected with the disease by milking cows suffering from cow-pox. He describes the appearances subsequently presented by the wounds, and states that, six weeks afterwards, the results of inoculating the boy with variolous matter were those commonly seen to follow the inoculation of persons who had previously had the cow-pox or the small-pox; that is to say, the "variolous test" showed the boy to be insusceptible to small-pox. Some months afterwards the boy was again inoculated, but no sensible effect was produced on the constitution. Jenner then relates that subsequently, in the spring of 1798, he inoculated a child, and obtained a similar result with matter taken directly from the nipple of a cow infected with cow-pox; from the pustule on the arm of this child he inoculated another, and from this again several, and from one of these latter a fourth in succession, and then a fifth. To three of these the "variolous test" was applied, and it is stated with the same results.

16. In considering the value of the "variolous test" as a proof of the immunity conferred by cow-pox, it must be borne in mind that most of the medical men at the close of the eighteenth century, Jenner included, had very considerable experience of the practice of inoculation; they were familiar with the varying effects of inoculation under different circumstances, from the cases where a genuine development of small-pox with a copious eruption resulted, to the cases where the effect was no more than the normal consequence of a puncture or incision by a clean lancet in the sound skin of a healthy man; they were called upon to decide, in cases giving rise to doubt, whether the effect of the operation had been the conferring of small-pox with the attendant immunity against future attacks, the welfare of the patient in view of subsequent exposure to contagion being dependent on the correctness of their judgment; and, making every

allowance for errors which must necessarily intervene in this as in other human judgments, there can be no doubt, as is pointed out in the detailed discussion of the "variolous test" to be found in the appendix on pages 143–5, that they had by experience learnt to know as a general rule whether or not the operation had so far produced the effects of small-pox as to confer the desired immunity. Nor is there any reason whatever to think that their attitude of mind was different when they used inoculation merely as a test of insusceptibility from what it was when they used the operation with the intent to provoke the disease. There does not seem then to be any sufficient ground for regarding the variolous test applied to cases of cow-pox in proof of immunity towards small-pox, as invalid, remembering of course always that in this, as in other things, a sanguine hasty person might be led by the desire of seeing his expectations fulfilled to minimise the effect of the operation; he might be led to overlook results which a more cautious observer would regard as evidence that small-pox had been really produced.

17. It is certain that Jenner believed that those who had suffered from cow-pox, whether naturally or artificially produced, exhibited when the variolous test was applied phenomena similar to those witnessed in the case of persons who had suffered from small-pox, and differing from the phenomena observed in those who enjoyed no kind of immunity or protection. If vaccination be without protective influence this ought not to have been the case. The symptoms should have been those of persons who had not suffered from small-pox and enjoyed no protection against it. If Jenner was an honest witness it is scarcely possible to believe that this was the case. His tests were applied for the very purpose of determining whether vaccination afforded protection. If the results presented were the same as would have been exhibited in unprotected persons it is difficult to conceive that he should have arrived at the conclusion that vaccination secured the same immunity as a previous attack of small-pox. It is true that in exceptional cases persons, who had never suffered from small-pox, showed when tested by inoculation the same absence of definite variolous symptoms as those who had been subject to the disease. These persons were spoken of as "naturally insusceptible" of taking the small-pox. It is just possible that all the vaccinated persons to whom Jenner applied the variolous test were thus naturally insusceptible. But that this should have chanced to be the case is of course in the highest degree improbable.

[illegible] ?

18. The experiences of Jenner did not stand alone. His results and views attracted great attention, and in the early part of the year 1799 Woodville and Pearson, who were physicians to the Small-pox Hospital in London, commenced making experiments with vaccine matter with a view to ascertain whether it afforded protection against small-pox. They arrived like Jenner at the conclusion that it did.

19. In January 1799 Woodville, having found cow-pox to be present in a "dairy" at Gray's Inn Lane, inoculated seven persons at the Small-pox Hospital with matter from one of the cows at the "dairy," and other persons with matter from sores on a dairymaid employed at the same place who had become infected from the cows. From these cases he inoculated in succession others at the Hospital, eventually to the number of many hundreds, and thus established the stock of what has been spoken of as "Woodville's "lymph." Pearson also at the same time occupied himself with the question of inoculation with the cow-pox, writing a pamphlet about it. Woodville and he distributed to many persons in this country and abroad quantities of the lymph from the Hospital; and this was the beginning of the more general practice of vaccination, for Jenner's stock of lymph, the results of which he had described in his treatise, had come to an end.

20. Although Woodville's "Hospital lymph" appears to have been widely distributed by himself and by Pearson, and thus to have been the source of the lymph used in various places in the early days of vaccination, it was not the only source, even in those days. Pearson also obtained lymph from cow-pox at a dairy in the Marylebone Road, and used this "in certain situations," which may be presumed to include places elsewhere than in the Hospital. He also speaks of having obtained lymph from the cow from a third source. Jenner again, who received and used some of Woodville's Hospital lymph, also obtained lymph from some other sources; for instance, from a cow at a Mr. Clark's farm in Kentish Town. Further, Woodville in 1800 speaks of his having at various times procured the vaccine virus as produced in different cows,

which when used at the Hospital produced the same effects as the Gray's Inn Lane lymph. We are not justified in assuming that an account of every new source of lymph was published; and there may have been others, it is impossible to say how many, than those just mentioned. In any case Woodville's Hospital lymph was not the only lymph used in those early days; not only, however, was it largely used (indeed we have no evidence of so widespread a use of lymph derived from any other source), but the use of it marks the definite beginning of the practice of vaccination; and the history of it demands special notice.

21. Of the cases recorded by Woodville in his Reports, the larger number, about three-fifths, presented an important and, as compared with Jenner's cases, a new feature, in that, in addition to the changes taking place at the seat of inoculation and constituting what Woodville called the "cow-pox tumour," which may here be spoken of as the "vaccine vesicle," an eruption over the body of a greater or less number of pustules was observed. These eruptive pustules occurred in the very first cases; of the seven cases inoculated from the cow, four, and of the five inoculated from the dairy-maid, four had such pustules; and their appearance is recorded again and again in the series, down to the case which appears last but one in the tabular statement forming part of the Reports.

Moreover an eruption of pustules is described in certain of the cases of which accounts were published at about the same time by Pearson and many others. In some of these cases the lymph used was supplied from the Small-pox Hospital by Woodville or Pearson.

22. It must be admitted, as will be seen from the detailed discussion which we give in an appendix at pages 145–153, that these pustules were pustules of small-pox, and that, therefore, Woodville's cases, which did so much to establish the practice of vaccination, were not cases simply of cow-pox but of cow-pox mixed, so to speak, with small-pox. It has indeed been maintained that Woodville's cases were not cases of cow-pox at all, that small-pox was inadvertently introduced into the very first cases; that the history of the whole series is the history of a series of small-pox cases putting on special characters, and that therefore the lymph used and distributed by Woodville and Pearson was in reality not cow-pox lymph but small-pox lymph. But a detailed discussion of all the facts such as will be found at pages 145–153, shows this view to be untenable. A review of all the evidence available leads to no other conclusion than that, however much in Woodville's, Pearson's and other cases cow-pox was mixed up with small-pox, the lymph used and distributed by Woodville and Pearson and called by them cow-pox lymph (excluding of course all the cases, of which there were not a few, in which matter was taken not from the local "cow-pox tumour" at the seat of inoculation, but from one of the eruptive pustules) was veritable cow-pox lymph having the true characters of cow-pox lymph only.

23. It of course follows that the cases, both in Woodville's practice and in that of others, in which the inoculation of cow-pox matter was accompanied by an eruption of pustules, due to small-pox being present as well as cow-pox, when appealed to as showing immunity against small-pox (by the test either of exposure to contagion or of inoculation), furnished false evidence as to that immunity being due to cow-pox; it might have been due to the accompanying small-pox. So far then as the adoption of vaccination was assisted by cases of this description, it may be held to have rested on erroneous data.

But the test of immunity, whether that of exposure to natural contagion or that of inoculation, was applied not only to the cases with eruption but to the cases without it, not only to cases where Woodville's lymph was used but to cases where lymph of other origin was used. We have no accurate records enabling us to distinguish these latter cases as regards immunity. Marshall makes a general statement that he found no difference between the cases inoculated with the lymph which we otherwise learn came originally from Woodville's case of Bumpus, and the cases in which the lymph employed was obtained from Clark's farm; but, though we learn from many scattered records that cases vaccinated by different persons showed immunity, we possess as a rule no details enabling us to distinguish the cases in which lymph obtained from the hospital was used from those in which the lymph was obtained from other sources, or indeed between the cases inoculated with lymph traceable to Woodville's earlier cases of Gray's Inn Lane origin and those inoculated with the various lymphs of other origin employed by Woodville. Yet it is clear that no contrast, as regards the immunity afforded, was presented between the cases where one lymph was used and those in which another was employed, or between those cases in which pustules appeared and those in which they did not. The reality of the immunity, so far as we can tell, was as great in the one class as in the other.

Moreover, admitting the error introduced by the pustular cases, it must be remembered that the error was of brief duration. The pustular cases, relatively numerous, at the outset, in the experience of Woodville and in that of some other observers, soon became exceptional in the experience of all. Within one or two years the error was recognised, and it was generally acknowledged that inoculated cow-pox differed clearly from inoculated small-pox in being as a rule unaccompanied by an eruption of pustules, and especially in not being contagious.

24. The view that cow-pox protects against small-pox thus put forward by Jenner, and supported by Woodville and Pearson, speedily attracted great attention among both the profession and the general public. Controversies, as might be expected, arose both on the main point whether protection was really afforded and on various subsidiary points; but, within a very short time, the new doctrine found general acceptance in England.

In 1800 a declaration of adhesion to the doctrine was issued with the signatures of many of the leading physicians and surgeons of London, and to this in the following year many others added their names. In various large cities the resident medical men made known collectively their approval.

1, App. 94–6. In 1802 a Committee of the House of Commons made a report on the utility of the discovery of the protective power of cow-pox, and upon Jenner's claim to be considered as the discoverer. A number of witnesses of extensive experience in the profession were examined. It is important to notice that the Committee not only stated the result of the evidence to be favourable to the protective effect of vaccination, but that vaccine inoculation "introduces a milder disorder in the place of the inoculated "small-pox, which is not capable of being communicated by contagion."

1, App. 97–9. 25. A few years later, controversies still continuing, the Royal College of Physicians made at His Majesty's command a report on the subject of vaccination to the House of Commons. This report was presented in 1807. The inquiry appears to have been a thorough one. No facts were regarded as proved, but those stated from actual observation. The College was made acquainted with the results of several hundred thousand cases, and the conclusion arrived at was that, though in some instances vaccination failed to protect, it afforded greater security against small-pox than the inoculation previously in use, whilst the illness induced by it was milder and less hazardous. It was further observed that in almost every case where small-pox had succeeded vaccination, whether by inoculation or casual infection, the disease had varied much from its ordinary course; it had neither been the same in violence nor in the duration of its symptoms, but had with few exceptions been remarkably mild. Moreover, it was pointed out that vaccinated persons spread no infection, and that cow-pox could only be communicated by inoculation. The report stated that towns and districts of the country in which vaccination had been general had afterwards had the small-pox prevalent on all sides of them without suffering from the contagion. Although the evidence before the College was not universally favourable to vaccination it was nearly so, and the important statement was made that many who were once adverse to the practice had been convinced by further trials, and were to be ranked amongst its warmest supporters. The College as the result of the inquiry felt it to be their duty strongly to recommend the practice of vaccination.

1, App. 110, 108. 26. From England the doctrine and the practice of vaccination rapidly spread to the continent of Europe. In Denmark a number of the most respectable physicians of Copenhagen formed themselves, in 1804, into a society to collect and investigate all grounds and arguments for and against the anti-variolous agent proposed by Jenner. A Royal Commission composed of medical men was at the same time appointed to investigate the subject. It is stated that after the lapse of a few years the private committee as well as the Royal Commission, although many of the members had at the commencement entertained a doubt as to the doctrine of Jenner, arrived unanimously at the conviction that vaccine virus was a preservative from small-pox.

In several European countries the utility of vaccination was early recognised by State action of one kind or another. Nor was this confined to Europe. In 1809–10 the State of Massachusetts passed statutes providing for inoculation with the cow-pox and giving power to raise money to pay for the operation. 6, App. 772-3.

Thus the doctrine that cow-pox protects against small-pox found an acceptance in most countries of Europe, and in the New World as great as it did in its birth-place, England. And without insisting too much on authority we may at least say, especially when it is remembered how slow men are to adopt new methods and how much prejudice is apt to exist against a novel treatment which is foreign in its origin, that such a widespread and rapid acceptance of the doctrine, in spite of hostile criticism, which was not wanting, shows that the evidence for it must at the time have appeared very strong.

27. It is impossible to trace with absolute certainty the source of the lymph used on the Continent and in other foreign countries. Pearson claims to have been the chief agent of the first distribution; and probably much, though, as has already been urged, not all, Pearson's lymph came from the Small-pox Hospital. Woodville started vaccination in France presumably with Hospital lymph. Indeed it is clear that in many instances the lymph with which vaccination was started in places abroad was supplied by Pearson or Woodville, and it is probable that much at least of this lymph had its origin in the cases of Woodville at the Small-pox Hospital spoken of above. But it is at the same time also clear that foreign observers obtained lymph from others than Pearson or Woodville. We learn that Jenner, who naturally was much appealed to for supplies of lymph, himself sent lymph to Stromeyer of Hanover (*Med. Phys. Jl., III.*, 471), to De Carro of Vienna (*Baron, I.*, 348), to Berlin (*Baron, I.*, 348), to Waterhouse in America (*Baron, I.*, 439), to Barbadoes (*Baron, I.*, 533), and to Newfoundland (*Med. Phys. Jl., V.*, 340); he may have sent lymph to other places, but his having done so does not seem to be recorded. Again, lymph derived from supplies originally obtained from Jenner, and sometimes spoken of as "Jenner's "lymph" or the "stock of Jenner," was sent abroad by several persons. Thus Waterhouse's first supply of lymph came through Haygarth from Creaser of Bath, "whose "stock was produced from the stock of Jenner," and Ring states (*Treatise, page* 20) that he distributed to "various parts of Europe and America" lymph derived from a supply sent to him by Jenner through Paytherus.* Lymph from Jenner, "Jenner's "lymph," must have been largely used abroad.

The lymph used by Jenner in those early days of vaccination was of two sources; that sent to him by Woodville, taken from the case of Bumpus at the Small-pox Hospital, and that obtained through Tanner direct from a cow at Clark's dairy-farm in Kentish Town. (Somewhat later he made use of another stock also furnished him by Tanner and supposed to be of equine origin.) We know of one instance in which he sent out lymph of the first of the above two strains, Woodville's lymph; he sent it to Ring, in whose hands it failed (*Baron, I.*, 358), and he may have sent it to others. But he certainly also largely used and distributed the Clark's farm lymph (*Baron, I.*, 343; *Crookshank, II.*, 258); he sent some of it to Woodville, who used it at the Small-pox Hospital. "Jenner's lymph" was certainly in part at least, probably largely, lymph derived from Clark's farm.

We do not know how far Jenner's lymph was successively carried on by the recipients abroad. Stromeyer (*op. cit.*) gave up the use of the lymph sent to him by Jenner, preferring that sent by Pearson; but at Berlin the use of Jenner's lymph seems to have been continued. The lymph sent to Waterhouse by Haygarth, though apparently successful at first, became useless later on; according to Waterhouse this was due to careless and ignorant management. Of the later supply sent by Jenner himself no such complaint is recorded, and this probably, together with that sent to Waterhouse from Ring which also was "Jenner lymph," continued to be used in Massachusetts; though it is impossible to separate the use of this lymph from that of the lymph received by Waterhouse from Woodville and Pearson (which was probably "Hospital lymph") and from Lettsom (*Baron, I.*, 471).

Unless we are prepared to assume (1) that all the lymph distributed abroad by Pearson and Woodville was derived from Woodville's original cases, and none of it from the other sources used by Pearson and even by Woodville himself; (2) that all the "Jenner's lymph" sent abroad by Jenner himself or by others was derived from the Hospital lymph sent to Jenner by Woodville, and none of it from the Clark's farm lymph, which Jenner used and distributed so largely; or (3) that all the Clark's farm strain sent abroad failed or was discontinued, the lymph of Hospital source alone maintaining its position; we must conclude that the lymph by means of which vaccination was established abroad was not exclusively that derived from Woodville's original cases. For such assumptions there is no positive evidence at all, and probabilities at least are entirely against them. Further, all the lymph employed abroad in the early days of vaccination did not come from England. Sacco, for instance, discovered natural cow-pox in Lombardy, and both he and De Carro, of Vienna, made large use, with positive results, of the lymph obtained from this source; its effects were identical with those of the lymph obtained from England, *i.e.*, from Woodville or Jenner. This Lombardy cow-pox is stated by De Carro to have been the origin of the lymph which he sent to Constantinople, and which started vaccination in the East. (*De Carro; Histoire de la Vaccine* 1804, *page* 23, *et seq.*)

Whatever may have been the case in the first instance as regards Woodville's and Pearson's lymph, it seems impossible to believe that the virus generally used in the early part of this century, whether in this country or elsewhere, was small-pox, and the process the old and well-known one of inoculation with that virus. If the evidence of the protection conferred by cow-pox be numerically lessened by some of the early supposed cases of cow-pox being really cases of small-pox, it is strengthened qualitatively by the absence of any contrast as to the immunity conferred between those who had been given cow-pox only and those who had been given small-pox as well or instead.

28. The data available for determining to what extent vaccination was practised in England in the first quarter of the nineteenth century do not permit of any exact numerical statements being made, but they at least show that the amount was considerable. Woodville, Pearson, Jenner himself, and others distributed virus to various practitioners all over the kingdom, and contemporary writings show that in the years immediately succeeding the publication of Jenner's treatise vaccination was practised with enthusiastic activity. The operation was repeatedly performed not only by doctors but by persons outside the profession; by clergymen and others, and even by ladies, as an exercise of benevolence. All this activity must have led in a few years to the vaccination of a considerable proportion of the population; and Jenner, writing in 1801, says that at the lowest computation some 100,000 of the inhabitants "within " these realms" had already been vaccinated. A little later the number was spoken of as several hundred thousands.

29. Beyond such general statements, however, one cannot go. Records exist, it is true, up to about the year 1807 of the numbers vaccinated in certain large towns in England, and there are also records of the numbers vaccinated during the first quarter of the century at the institutions established in London for the vaccination of the poor. But these hardly do more than support the general statement that vaccination was largely practised. An attempt has been made to calculate, upon the basis of the returns of the above institutions, the proportion of the population in London which was vaccinated during the first twenty years or so of the century; but the data are too uncertain to allow of any value being attached to the result.

30. Incidental references in contemporary writings seem to show that, after about 1805, the first enthusiasm for vaccination somewhat diminished and the practice tended to decrease; but the check seems to have been transient only, for such scattered data as can be obtained show that the practice was very prevalent during the latter part of the first quarter of the century. This is strikingly illustrated by two records, one in London, the other in the country.

Of the children (over 8,000, all under 12 years of age) admitted into the Royal Metropolitan Infirmary between October 1820 and April 1822, 41 per cent. had been vaccinated, and 6 per cent. inoculated.

At Cambridge in 1824 of the 8,112 inhabitants under 25 years of age (who had been born therefore since the introduction of vaccination) 48·7 per cent. had been vaccinated.

At Norwich, in 1819, it was calculated that out of a population of 40,000 about 10,000 had been vaccinated; but there is no statement as to the ages of the vaccinated. The distribution of the vaccinated was irregular, for of 603 persons forming families specially examined only 91 had been vaccinated, and of these only 57 previously to 1819.

There are no reasons for thinking that, so far at least as towns are concerned, Cambridge was in any way exceptional as regards vaccination. On the other hand, the great similarity of the results in places so different as London and Cambridge, go far to justify the supposition that, could data be obtained, they would show a like state of things in the towns generally. If so it may be concluded that at the end of the first quarter of the nineteenth century, at any rate in towns, a proportion approaching the half of the children born during that quarter were vaccinated. As to the vaccination of those who were adults at this period, hardly any information exists, but incidental references show that at least in the early days of vaccination many adults were vaccinated. To the number of the vaccinated young there must therefore be added an unknown number of persons vaccinated in adult or advanced life. No statistical information is available to show whether the state of vaccination in rural districts differed, and if so to what extent, from that which prevailed in towns.

31. Passing to countries other than England, Sweden deserves attention on account of the relatively complete records existing there. These give not only the population, the births, the total deaths, and the deaths from small-pox from the year 1774 onward, but also from 1804 onward the numbers vaccinated. Vaccination was introduced into Sweden in 1801, and in 1816 was made compulsory in so far that a fine was imposed for nonconformance. In 1804 the number of vaccinations during the year amounted to a third of the number of births, and after some fluctuations in succeeding years reached, in 1825, 70 per cent. of the births. Small-pox was very prevalent in Sweden during the latter part of the eighteenth century and the year 1800 had been marked by a most severe epidemic. Hence a large proportion of the population at the introduction of vaccination had had the small-pox and would consequently not be vaccinated; the vaccination during the nineteenth century would fall chiefly on those born during that century; and the near approach of the number vaccinated to the number born shows that a very large proportion of the total population not protected by previous small-pox was vaccinated. Report page 6, App. 752.

32. In Denmark, into which vaccination was introduced in 1801, being made compulsory in 1810, similar records exist, and here the number of those vaccinated more closely approaches, and in some years even exceeds, the number of births; so that a still greater proportion of the population, not protected by previous small-pox, was vaccinated. Report page 1, App. 110, 108.

33. If vaccination have the protective influence alleged, in view of the extent to which we have shown that it was practised in the first quarter of the present century, its fruit ought to be seen in a diminution of the mortality from small-pox during that period. This brings us to the second of the two questions which we have said presented themselves: Does the history of small-pox mortality since vaccination was introduced afford warrant for a belief in its protective effect? This, of course, involves an inquiry into any other possible causes affecting the amount of small-pox mortality. We enter then upon the first stage of this inquiry, confining our attention for the present to the period we have indicated.

Does the history of small-pox mortality since vaccination was introduced afford warrant for a belief in its protective effect?

(i.) The period 1800–1825.

34. It becomes necessary at the outset to consider the subject of small-pox mortality and its prevalence prior to the introduction of vaccination, and especially during the latter part of the eighteenth century, the period immediately prior to its introduction.

35. The early history of small-pox, like that of many similar diseases, is obscure, is subject to much debate, and, save perhaps on one point, is of antiquarian interest only. The records of the eighteenth century show that the disease was very prevalent in western Europe during the whole of that century; we shall discuss the history of the disease during that period in some detail presently. The records of the seventeenth century also show that small-pox was a very common disease during that century; this is especially the case as regards the latter half of the century. The statistics which exist with respect to Geneva, and various scattered statements, further show that small-pox was a well-known disease in the sixteenth century, but except for the records which are said to exist of severe epidemics in Iceland taking place as early as 1241, as we go further back the evidence as to the existence of the disease becomes less and less clear, and indeed debateable, depending as it does largely on the interpretation of incidental statements in various medical and other writings. There seems, however, to be adequate proof of the prevalence of small-pox in the East, in Asia Minor and other countries, even in the earlier centuries of the Christian era. 1, App. 109–10.

A view very generally taken teaches that small-pox, introduced from the east, began to be common in western Europe during the fifteenth century, though perhaps existing still earlier, that it increased during the sixteenth and seventeenth centuries, especially the latter, and that it was very prevalent during the eighteenth century. It will be desirable not to discuss this view at length, but to confine our attention to the history of the disease in the seventeenth and eighteenth centuries.

36. In dealing with the eighteenth century it must be borne in mind that during the second half of the century the natural conduct of small-pox, as we shall see later on, was modified by the practice of inoculation, that is, by the artificial giving of the disease by the introduction of the virus through a wound in the skin; but it will be convenient to consider in the first place the century as a whole, and to discuss later on the effects of the practice of inoculation.

37. Our knowledge of the history of small-pox in western Europe during the seventeenth and eighteenth centuries is very largely based on the official records known as the "London Bills of Mortality." Official records bearing on small-pox are furnished by Geneva, going back as far as the sixteenth century, by Sweden, going back to the year 1749, and by some other places. Data are also furnished, especially for the latter part of the eighteenth century, by parish records in various parts of Great Britain reaching over a variable number of years as well as by scattered statements in various works. But it is chiefly to the London Bills of Mortality that appeal is made for support to the different views maintained as to the behaviour of small-pox during the period with which we are dealing.

38. These Bills, which when established were issued weekly, with a general *résumé* at the end of the year, purport to give an account of all the burials and christenings taking place in certain enumerated parishes within and without the walls of the city and also within and without the "liberties." The earlier Bills, issued before the year 1629, gave only the total deaths and the deaths from plague; but from 1629 down to 1845, with a gap from 1637 to 1646 (both years included), the causes of death, including small-pox, are specified. From 1629 to 1636 and from 1647 to 1686 inclusive, the entry is for "flox and small-pox," and from 1687 to 1700 inclusive measles are included with "flox and small-pox." These Bills accordingly afford data of some value for judging of the effects of small-pox in London from 1629 to the close of the eighteenth century and beyond.

39. Their value, however, for exact purposes will be seen to be diminished when the following considerations are borne in mind:—

The Bills record not all the deaths taking place within the area of the Bills, but only those made known to the parish clerks in view of burial in the parish churches. Hence the deaths given in the Bills must always have been less in number than those actually taking place. For, on the one hand, it was a not uncommon practice when a person died in London for the corpse to be taken into the country for burial, and, on the other hand, many Dissenters and many Catholics were buried elsewhere than in the Church of England burial grounds. But it is not possible to ascertain how many deaths there were thus in excess of the deaths recorded in the Bills; and, what is a matter of no little moment, this excess probably varied considerably from time to time.

Even if we accept the record of the deaths recorded as approximately correct, this cannot be trusted implicitly to yield exact conclusions as to the mortality from small-pox, since the population of the area covered by the Bills is not known with certainty. Further, when one period is compared with another, a difficulty is introduced by the fact that from time to time fresh parishes were added to the area from which the Bills were gathered. Then again, it must be remembered that even at that early time, as now, the population of London differed from an ordinary population, from that for instance of a country district, inasmuch as it was not so largely determined by the relation of the births to the deaths. A large number of persons, chiefly adults, were continually entering into and taking up their residence in London, and in like manner a large number of adults were for one reason or another continually leaving it. It has been calculated that in 1685 the population within the Bills of Mortality was 530,000, and in 1750, 653,900; but it is obvious that such calculations can have an approximate value only. In 1801, the population was ascertained by census to be 746,233.

It may be added that the women searchers, "ancient matrons" of low estate and uneducated, were directly responsible for the statements as to the cause of death. Though these women were probably guided in their statements by the opinions of the doctors attending the cases, or by the reports of such opinions, they must have given rise to much error. In the case of death from small-pox, however, there was in all probability less liability to error than in some other diseases.

40. Quite apart from all calculations, the Bills clearly show that from 1629 onwards, throughout the remainder of that century and the whole of the next, very many per-

sons died in London from small-pox. During the latter half of the seventeenth century the yearly deaths fell below 500 on eight occasions only. The return of one year, 1666, conspicuous for the smallness of the number of deaths, 38 only, is intelligible when it is remembered that this is the year succeeding that of the Great Plague. The Bills also show that in both centuries the disease had an epidemic character, the returns of certain years being much greater than those of others. In many instances the epidemic increase is marked in one year only, the returns of the succeeding year being, as a rule, low, but not unfrequently the epidemic lasted over two or more years; and this appears to have occurred more frequently in the eighteenth than in the seventeenth century. Indeed, the variations of the numbers are, as a rule, more abrupt in the latter than in the former period.

41. When we turn to the important question of the mortality from small-pox, that is to say, the proportion of deaths to the number of persons living, we are met with the difficulty of the population not being exactly known. As already stated, it has been calculated that the population in 1685 was 530,000. On the basis of this datum, the average yearly death-rate of, or *mortality* from, small-pox in the ten years around this date, namely, in the years 1681–90, was 3 · 139 per thousand; the mortality from all causes of death being 42 · 2 per thousand. Similarly in the ten years 1746–55, on the calculation that the population in 1750 was 653,900, the yearly mortality from small-pox was 3 · 044 ; that of deaths from all causes 35 · 5 per thousand. Taking the same calculations as to population we find that in years when the deaths from small-pox were very high, the mortality from small-pox, both in the seventeenth and eighteenth centuries, was frequently 3, 4, 5, or even more per thousand. Even if we take the years in the eighteenth century in which the returns of deaths from small-pox were the lowest, viz., 1702, 1753, 1782, we find, still using the above calculations, the mortality from small-pox 0·6, 1·2, and 1·0 respectively, and in 1797, using the census of 1801, the death-rate was 0 · 7. And in most of the years of that century the mortality from small-pox was either not far below, or very distinctly above, 2 per thousand. All this means, even when every allowance is made for the insecurity of the calculations, that the mortality from small-pox in London was, during the eighteenth century, very high. This is a broad conclusion which may be considered as definitely proved.

42. It is further confirmed by the indirect measure of the mortality of small-pox which is offered by the proportion of deaths from this cause to deaths from all causes. This has the value of being independent of the actual population; and, so far as can be judged, is not vitiated by the record of the small-pox deaths being influenced by anything which did not also influence the records of the other deaths. On the other hand, its value is very largely lessened by the fact that the ratio is determined and influenced by circumstances affecting other diseases and not small-pox itself. It may, however, be trusted so far as to show that the ratio during the seventeenth and eighteenth centuries was very high, and, on the whole, higher during the eighteenth than during the seventeenth century. Further, if we assume, as we have probably the right to do, that the total death-rate was during those centuries very high, as compared, for instance, with the present time, we may infer that the death-rate from small-pox was very high, and the disease either very fatal or very prevalent.

43. The Bills give no information whatever about the number of persons attacked by the disease, and therefore teach us nothing as to the *fatality* of the disease, that is to say, the proportion of deaths to the number of cases attacked. We learn, however, by the incidental statements of various authors, that the fatality varied very much in different years, that is, in different epidemics. An epidemic was often spoken of as being either mild or malignant; in some epidemics, though many might be attacked, the proportion of those who died was small; in others the disease proved fatal to a large number of those attacked.

44. Although from 1728 onwards the Bills give the ages at death, the numbers have not been analysed so as to show the " age incidence " of the small-pox mortality, that is to say, the relative mortality at different ages. And the Bills furnish no data for determining how such influences as those of station in life, sanitary conditions, and other circumstances affected the mortality.

45. These Bills of Mortality form, as we have said, by far the most complete source of our knowledge of small-pox in England in past times; but it must be borne in

mind that in respect to any contagious disease like small-pox the conditions of London were peculiar. The population was to a marked extent a moving one; a large number of persons were continually entering London or leaving it, were passing to and from it, from and to the provinces of England and other countries. Of these persons some, coming from infected districts, brought into London fresh sources of contagion; others again, coming from districts free from small-pox, and never having had the disease, brought into London fresh material to serve as food for the disease. Further, London presented in an exaggerated degree the two features of a great city which have a great influence on the progress and characters of a contagious disease like small-pox. The crowding both of the dwelling-places and the thoroughfares, as well as the movement continually going on, multiplied the opportunities for the spread of disease, and the accompanying insanitary conditions, as well as the greater inducement to irregular living, tended to increase the severity of the disease when taken, and to heighten the mortality from it. The history of small-pox in London must not be taken as representative of the history of small-pox in England generally.

46. Apart from the London Bills of Mortality, our information concerning small-pox in England in past times is limited to the records of various scattered places, records confined in most cases to short periods, chiefly in the middle or latter part of the eighteenth century, or to incidental accounts and remarks. From these it would appear that in some places and at times small-pox was exceedingly prevalent, and at other places or at other times at least rare if not exceedingly so.

Chester

47. A valuable and instructive record is that given by Haygarth of an epidemic of small-pox in Chester in the year 1774. Out of a population of 14,713 there occurred during the year 1774, 1,202 cases of small-pox, of whom 202 died. On the 1st January 1775, it was ascertained that 1,060, that is about 7 per cent. of the population, had not had the small-pox during the previous year or at any earlier time. This was after the epidemic which, as the figures showed, was severe; before the epidemic, on the supposition that none of those who took the disease in 1774 had suffered from it before, the numbers who had not had it on the 1st January 1774 were 2,262, or 15 per cent. of the whole population, and of these more than half were attacked before the end of the year. Although experience shows that the hypothesis that none of those who were attacked in 1774 had previously suffered from the disease is not likely to be accurate, it shows also that the number of those who suffered a second time is not likely to have been so numerous as seriously to affect the calculation.

Warrington

A record exists of an epidemic at Warrington in 1773. In a population estimated at 8,000 there were, during that year, 211 deaths from small-pox. The deaths from all causes during the same period amounted to 473.

Ware

Again, in the small town of Ware in 1722, out of a population of 2,515, at the beginning of the epidemic, 1,601 had previously had the small-pox; leaving 914 susceptible persons. Among these there were during the epidemic 612 cases with 72 deaths, leaving at the end of the epidemic, 302 persons who, having escaped the attack, are spoken of in the record as "to have the small-pox."

48. These records do not merely show the severity of the epidemics with which they deal, comparable with those of London, but those of Chester and Ware also show, what is much more important, how small a portion of the population in such places had not suffered from small-pox at some time or other. They show that in a provincial city and in a small agricultural country town there were epidemics of small-pox during the period with which we are dealing comparable with those disclosed by the London Bills of Mortality. There is no reason to think that the condition of things in Chester or in Ware was exceptional; it may probably be taken as illustrative of like towns elsewhere.

49. On the other hand, there is evidence that in the eighteenth century in some districts of England small-pox was very rare. Thus in three small rural parishes in Kent with a united population of 1,088 there were recorded during 20 years in the latter half of the century only 10 deaths from small-pox. 4, App. 398.

There are no means of ascertaining to what extent a like paucity of small-pox existed in other rural districts of England. Haygarth, in referring to the rural parishes just quoted, states it as his opinion that in his own neighbourhood such a freedom from small-pox was unknown, and was probably so wherever inoculation was practised.

50. In one respect the provinces differed from the metropolis. In London, as we have seen, small-pox was always present during the eighteenth century; though in some years the deaths from small-pox were more numerous than in others, a large number died every year; even in the years quoted above as yielding the lowest returns, the yearly number of deaths is still considerable. In the provinces, as is shown by records and numerous incidental statements, the disease had a more distinctly epidemic character, especially in towns other than the great cities and in rural districts. Thus in the small parish of Kilmarnock the records show that the small-pox was severe every few years, between which there were no deaths at all from small-pox or very few only. Hence we may conclude that though in the districts where for one reason or another epidemics did not make their appearance, as in the Kentish rural parishes, the mortality from small-pox was low, yet where epidemics did make their way the prevalence of small-pox was great and the mortality from it high, comparable indeed with that of London. Q. 24,823, 24,979.

51. Records exist of the deaths from small-pox in the times previous to the nineteenth century in countries other than England. Thus, in Sweden records from 1774 to the end of the century (and beyond) give both the population and the deaths from small-pox. (The records go back to 1749, but up to 1774 the deaths from small-pox and measles were not distinguished.) These show great variations in the yearly mortality from small-pox. In some (epidemic) years, the mortality was very great, greater even than that of London, as calculated from the Bills of Mortality in the manner described above; on the other hand in many years the mortality was much lower than that ever reached in London during the same period. In Sweden as a whole, as in the provinces of England, the disease had a very marked epidemic character. Similar records relating to Copenhagen and Geneva, the last reaching back to 1580, and other places, all confirm the conclusion as to the great prevalence of, and high mortality from, small-pox in Western Europe during the eighteenth century and earlier. 6, App. 752; 1, App. 112. 1, App. 107.

52. But perhaps the most striking evidence in favour of this conclusion is to be seen in the fact that the chance of taking the disease and of dying from it was made the subject of mathematical treatment by distinguished mathematicians of the time. Thus Daniel Bernouilli, writing in 1760–5, takes as one of the bases of his calculation the datum (arrived at by means of various records in various places) that small-pox carries off the thirteenth or fourteenth part of each generation; or in other words, that the deaths from small-pox are about one-thirteenth or one-fourteenth of the deaths from all causes. The same author uses another datum obtained in a similar way, namely, that the eighth or the seventh part of those attacked die of it. From this, it follows that something like 40 per cent. of those born died without having small-pox. Since of these so dying a large number died at an early age, the number of those dying in adult and in advanced age without ever having had the disease would be much less. And in this sense, probably, must be read the statement of Haygarth, which he gives without supplying the data on which it is based, namely, that "some persons are incapable of infection by the small-pox. The "proportion of mankind thus exempted has been observed to amount to 1 in 20"; that is to 5 per cent. The persons here referred to are probably those who lived to an advanced age without taking small-pox, though exposed to infection and possibly (for Haygarth wrote in the inoculation period) subjected to inoculation.

That Bernouilli should use data like the above for an elaborate work, and that a careful observer like Haygarth should make such a statement as that above quoted, emphasizes the conclusion as to the great prevalence of small-pox in the times in question.

53. We may pass now from the mere prevalence of or the mere mortality from small-pox to its fatality in those days. Much controversy has arisen on this point, and much has been made of the statistics of Dr. Jurin on this head. The returns furnished to him of the number of cases attacked, and of the number of deaths of those attacked, during epidemics in various places in England and America, showed an average rate of fatality of 16·5 per cent. amongst those attacked. This, which does not differ much from the datum employed by Bernouilli, has been put forward by many as being about the natural fatality of small-pox duirng the 18th century. It has been urged that the deaths of those dying under two years of age were excluded from Jurin's statistics, and that this must have led to the omission of many deaths, as the mortality in that class was high. The evidence relied on to show that cases

under two years of age were excluded certainly cannot be regarded as establishing it. It is to be observed that although the average fatality in what are known as Jurin's cases was only 16·5 per cent., the fatality in the various epidemics from which those statistics were compiled varied greatly, ranging from 10 to 36 per cent. There are instances where the fatality has been even less than 10 per cent. As has been already remarked, the fatality of small-pox differed very greatly in different epidemics. Bernouilli, in taking the average fatality quoted above, remarks on its great variability, it may be as high as 1 in 3 (and indeed still higher results have been recorded), or as low as 1 in 40. The records of the London Small-Pox Hospital from 1746 to 1763 showed a fatality of 25·3 per cent., and it has been stated that during the last 25 years of the last century 32 per cent. of those admitted succumbed to the disease. In the Bill of Mortality of the town of Warrington for the year 1773, by the Rev. J. Aikin, communicated by Dr. Percival to the Royal Society of London, it is stated that in one neighbourhood, out of 29 who had the disease 12 (that is to say, 41·3 per cent.) died. He states, further, that in other neighbourhoods the fatality was still greater, and that he had reason to believe that it was not less on the whole. There can be no doubt that the fatality of small-pox differed very greatly in different epidemics. So great are the variations that only very large numbers would justify an average being accepted as showing what may be called the normal or natural fatality. It is much more important to bear in mind that the fatality differed widely on different occasions.

54. One character of the small-pox in the eighteenth century (and there is nothing
to prove the state of things before the eighteenth century to have been different) is
brought out in all the records in which the ages are given, namely, the large proportion
of the deaths contributed by the very young. Thus in Chester, in the epidemic of
1774, all the 202 deaths were of those under 10 years, and a quarter of them under
one year. In Warrington in 1773, all the deaths were of those under nine years. In
Q. 24,823, 24,979. Kilmarnock, of the 622 deaths occurring between 1728 and 1763, the ages of nine not
being given, only seven were of those above 10 years. The burial registers for the
graveyard of St. Cuthbert's, Canongate, and Buccleuch Street, Edinburgh, show that
6, App. 642. Report page during the years 1764–83, the proportion of deaths from small-pox of those below the
age of ten years, to every thousand deaths from that disease at all ages, was 993.
Indeed in all records of epidemics in which the ages are given, the mortality was mainly
amongst infants. It is also seen in the larger records, covering periods including both
epidemic years and years which were not epidemic, as in those of Geneva (1580–
1, App. 76. Report page 1760), which show that the feature was apparent earlier than the eighteenth century,
in those of Sweden (1774–1800) and in those of other places. Incidental references
in various writings show that the fact was recognised at the time; thus Haygarth
observes that in Chester in the years 1772–1777, of those under 10 years, "half as
"many die of the small-pox as of all other diseases"; and this feature of small-pox
is assumed in the calculations of Bernoulli referred to above.

55. The first quarter of the 19th century was characterised in this and other countries by a striking decrease of small-pox.

56. In the London Bills of Mortality the returns of small-pox for the year 1800 are 2,409. This was the last return so high as 2,000. From thence onward the number of deaths from small-pox fell, especially after 1810, reaching in 1818 so low a figure as 421; the fall being irregular and marked by epidemics as in 1812, 1817, and 1825. This decline is all the more striking since during this period the population of London within the limits of the Bills, increased from 746,233 in 1801 to 1,180,292 in 1831. As has been already urged the Bills were imperfect, and there is ground for believing that during this quarter of the century the imperfections were greater than in former times. This is confirmed by the fact that the returns of the total deaths, in spite of the increased population, were on the whole not greater, in many years even less, than in the preceding century. Making every allowance for the effects of improved sanitary conditions, this feature of the returns may be taken as evidence of their imperfection. Still, in spite of their imperfect character, the Bills show that during this quarter of the century, a striking change took place in small-pox in London.

57. Adequate records of the prevalence of and mortality from small-pox in parts of England other than London, during the first 25 years of the nineteenth

century, are not available; but that in the provinces, as in London, a very great change had taken place is shown by comparing the condition as regards small-pox of towns at, or towards the end of, this period with that of towns during the last century.

In Cambridge, with a total population of 14,142 in 1821, the number of persons who, up to the summer of 1826, had had small-pox during the preceding 25 years was 3,560, or about 25 per cent. These figures result from the answers given to inquiries in a house-to-house visitation, and being dependent on the memory of those interrogated can have only an approximate value. Moreover, they of course omit all who had small-pox anterior to the 25 years. On the other hand, a severe epidemic of small-pox took place in Cambridge in 1823–4, and the deduction of the 686 cases of that epidemic from the numbers above, reduces the per-centage to about 20. The population born during the above 25 years amounted to 8,112; of these 34·4 per cent, had had small-pox, 12·7 per cent. by inoculation.

In Chester, of which previous mention has been made, with a population in 1774 almost the same as that of Cambridge in 1821, viz., 14,713, by the 1st January 1775 all but 1,060, that is about 93 per cent., had had small-pox at some time or other. The year 1774 was marked by a severe epidemic of small-pox, the number of cases being 1,202; hence of the population on the 1st January 1774, all but 2,262, or about 85 per cent., had had small-pox.

Again in Ware in 1722, of which mention has also previously been made, of a population of 2,515 all but 302, or about 82 per cent., had had small-pox. That, again, was after an epidemic, of 612 cases; so that the per-centage before the epidemic was about 64.

Data, more fragmentary, exist concerning Norwich in 1820, which city with a then population of about forty thousand had had epidemics of small-pox in 1805, in 1807–9, in 1813, and in 1818–9; the last being very severe, the deaths for the year 1819 being 530, a mortality of about 13 per thousand. Mr. Cross (*History of a Variolous Epidemic, page* 38) states that visiting 500 families, with 1,377 persons under twenty years of age, he found that 715 (or more probably 726), *i.e.*, about 52 per cent., had had small-pox. But of these 357 (more probably 368) had had the disease during the recent epidemic, and 358, or about 26 per cent., had had it earlier. He further states that of 603 persons, forming the 112 different families in which the 200 cases of small-pox which came under his notice during the epidemic occurred, 497 (or roughly 70 per cent.) had had the small-pox at some time or other. Of these 297 (or about 50 per cent.) had had the disease previous to the epidemic. No mention of age is made in the latter statement, and the former statement probably gives a more correct idea of the general condition of the city. If so Norwich did not differ as to its condition in regard to small-pox very widely from Cambridge, and like it presents a contrast to Chester, not so striking a one, but still instructive, since Norwich in the first quarter of the present century, like Chester in the last century, suffered from severe epidemics of the disease.

58. The data of the two epochs are not exactly comparable; though, from what has been stated concerning the age-incidence of small-pox in the eighteenth century, the greater part of those who suffered in Chester and Ware had probably had small-pox within the previous 25 years. Moreover, the data in any case are approximative only. Still, making every allowance, the contrast between the two epochs confirms the conclusion as to the decline of small-pox in the provinces in the first quarter of the nineteenth century.

59. If leaving England we turn to other countries, to Sweden for instance, in which 6, App. 752.
as has been seen records more exact than those in England exist, the same marked change is apparent, indeed is still more clear. As has already been stated, the small-pox mortality in Sweden from 1774 to 1801 was very high, comparable to that
of London, though more strongly marked by epidemic variations. This state of things 1, App. 112.
is shown as far back as 1749, but less exactly on account of measles and small-pox being returned under the same head between 1749 and 1773. In 1800, a great epidemic year, the mortality was over 5 per thousand, and the yearly average of the period 1774–1801 was over 2 per thousand. From 1801 onward there is a fall, becoming great after 1809; the yearly average reaching 1 per thousand in one year only, 1809, falling after 1816 often below 0·1 per thousand and, indeed, in one year reaching 0·04 per thousand, but rising again to nearly 0·5 per thousand in 1825.

60. A similar change is shown by the exact records of Copenhagen which 1, App.
reach back to 1750. Small-pox was prevalent up to 1801, then suddenly declined, 107–8.

Indeed for a while it quite disappeared, no deaths being recorded between the years 1810 and 1824.

61. And a similar change is seen in such records as are available relating to other countries of Western Europe and to the United States. In all cases the first quarter of the new century is marked by a great diminution of small-pox deaths.

62. What was the cause, or what were the causes, of this marked decline of small-pox in the first quarter of the nineteenth century? Was it due to the introduction of vaccination, or is it to be otherwise explained?

63. One effect of the introduction of vaccination was a very great decrease in the practice of inoculation, which had become very prevalent during the later part of the previous century. And the view has been put forward that, the prevalence of inoculation having greatly increased the amount of small-pox, the diminution of small-pox in question was the result of the decrease of inoculation.

64. The practice of inoculation for the small-pox, that is the artificial introduction of the virus into the system by the insertion of fluid from a variolous pustule into wounds of the skin made for the purpose, began definitely in England towards the end of the first quarter of the eighteenth century. Attention was directed to the matter by letters from Timoni of Athens (dated 1713) and Pylarini, published in the 29th volume of the Philosophical Transactions (1716), and especially by a letter from Lady Mary Wortley Montagu in 1717. Though there are indications that in Great Britain and Ireland, as in other countries, some sort of inoculation had occasionally been practised at a much earlier date, the first clearly recorded case in England is that of the daughter of Lady Mary Wortley Montagu (whose son had some time before been inoculated at Constantinople), inoculated by Maitland, in London, in April 1721. Other cases soon followed in England, and about the same time the practice was also introduced in other countries of Western Europe, and into the United States of America, namely, at Boston.

65. It was found that the attacks induced by inoculation were as a rule milder, and very much less fatal than the attacks of the "natural" disease, the fever and constitutional disturbance being less and of shorter duration, and the eruptive pustules much fewer; the number of these varied, being commonly a dozen or two, sometimes only two or three, sometimes a hundred or more. In some cases there was no eruption at all, the effect being limited to constitutional disturbances and to changes in the wounds of inoculation themselves; it was maintained that in such cases the disease had really been taken, and immunity against a subsequent attack secured, as in cases of natural small-pox or of inoculated small-pox manifesting itself in an eruption of pustules.

66. In England the practice of inoculation at its introduction, though much lauded and strongly urged by some, was bitterly opposed by others. Moreover, the initial enthusiasm in favour of it soon declined, so that in the years 1730–40 very little inoculation seems to have been practised. About 1740, however, a revival appears to have taken place; in 1746 an Inoculation and Small-pox Hospital was started in London; and during the whole of the latter half of the eighteenth century the practice may be said to have been very general. It was especially so during the last quarter of the century, the increase being at least largely due to the "improved methods" of inoculation introduced by one Sutton in 1763, and known as "the Suttonian "method."

67. This method, carried out by Sutton himself and his immediate associates, as well as in a more or less modified form by Dimsdale and others, had for its object the securing that the attack induced by inoculation, while remaining a veritable attack of small-pox and so bringing immunity against future attacks, should be as mild as possible; that the constitutional disturbance should be slight and of short duration; that the eruptive pustules should be few, or even absent altogether; and that a fatal issue, the somewhat frequent occurrence of which had in the early days been a great obstacle to the spread of the practice, should be rendered at least very rare indeed, if not impossible. Concerning the essentials of the method, which Sutton attempted to keep a secret, there has been much discussion; they seem to have consisted partly in a

proper care or regimen of the patient before, during, and after the inoculation, partly in the mode of inserting the virus, and partly in making use of the fluid of the variolous vesicle at a relatively early stage.

68. There can be no doubt that between the years 1770–1780 inoculation was very widely practised in England, and there is no evidence to show that any marked decline in the practice took place during the remainder of the century. But the distribution of the practice was very unequal. It was much more common among the rich, or at least, among the well-to-do, than among the poor, though many benevolent efforts were were made "to extend its advantages" to the latter. Again, in some districts, as in Essex and Herts, the home of Sutton and Dimsdale, and in Yorkshire, the practice was very widespread. On the other hand, parts of Kent and Sussex are quoted by Haygarth in 1793 as having been practically free from inoculation, and similar statements as to the paucity of inoculation in this or that district are made by other writers of about the same period.

There are no records giving exact information as to the amount of inoculation practised in London, but, seeing that it was favoured by the rich, and that on the other hand opportunities for the poor were afforded by the Inoculation Hospital, we may, perhaps, conclude that the practice was at least very general.

69. What influence, then, had the practice on the prevalence of, and on the mortality from, small-pox, during the latter half, and especially during the latter quarter of the eighteenth century?

70. Since an inoculated person was infectious, each inoculation was a source of danger to those, not protected by a previous attack, who came into the company of, or even near, the inoculated person during the attack; and this danger was increased by the fact that the mild character of the inoculated disease permitted, in many cases at least, the patient to move about among his fellows. Moreover, as Haygarth, himself a zealous advocate of inoculation in a systematic regulated manner, points out, the beneficial results of inoculation had robbed the disease of its terrors to so great an extent that the rich and powerful no longer made the efforts which they formerly did to prevent its entrance into, or its spread in, their neighbourhood, and thus favoured its spread among the unprotected poor; so that inoculation "though eminently useful "to the rich appeared to be injurious to the poor." Adding, therefore, together the cases of inoculated small-pox, and the cases of natural small-pox of which the inoculated cases were in one way or other the cause, it seems probable that inoculation did tend to increase the *prevalence* of small-pox; but there are no recorded data to show that this really was the case, and this supposed influence may have been counterbalanced by other influences.

71. The evidence as to the influence which inoculation had on the mortality from small-pox is in many respects conflicting. Haygarth, though he admits that in other parts of the kingdom the practice may have saved many lives, was persuaded that in his own part of England and Wales the deaths by the small-pox had been augmented by it; and he points out that in London, Geneva, and other "towns in "different situations and circumstances the mortality from this distemper has "increased since the introduction of inoculation." Several writers in the latter part of the last, and the early part of the present, century held a similar view. Other writers, again, opposed this view.

72. Much use has been made of the London Bills of Mortality as bearing on the question. These, as has been pointed out, seem to show, in spite of all their imperfections, that the small-pox mortality in London was greater during the eighteenth than during the seventeenth century; and it has been urged that the increase was, in part at least, or even largely, due to the introduction of inoculation.

The several quarters of the 18th century need, in respect to this point, to be distinguished. During the first quarter there was, broadly speaking, no inoculation at all; the few cases from 1721 to 1725 may be neglected. During the second quarter there was very little inoculation, the practice not beginning really to increase until after 1740. During the third quarter the practise rapidly increased, culminating with the introduction of the Suttonian system in 1763. And the great prevalence of the practice appears to have continued during the whole of the last quarter.

Had inoculation been the main cause, or even a large cause, of the increase of mortality during the eighteenth century, this increase would be expected not to be prominent until about the middle of the century, to rise rapidly during the third quarter and to be more or less stationary during the last quarter. On the contrary, whether the severity of the disease be judged by the total deaths recorded in the Bills, or by the proportion of small-pox deaths to deaths from all causes, or by the mortality calculated on the supposed number of inhabitants, or by the relative severity, frequency of occurrence and duration of the epidemics, such increase as the Bills show in the severity of the disease during the first quarter, when there was no inoculation at all, and during the second quarter, when there was very little, is as marked as, or more marked than, during the latter quarter, when inoculation was most prevalent. The Bills, therefore, do not show that inoculation was the main, or a large, cause of the greater mortality from small-pox in London during the eighteenth century.

73. It must be borne in mind that inoculated small-pox was on the whole much less fatal than that naturally acquired. The class of inoculated persons may thus have contributed less to the fatal cases of small-pox than if they had been left to the chances of natural contagion.

74. That inoculation might have the effect of diminishing very largely the mortality from small-pox is shown by the records of Boston, U.S.A. In these, the cases of and deaths from small-pox, both natural and inoculated, are given for a series of years; and, the population being known, the mortality can be exactly determined. The diminution both in the whole mortality from small-pox and in the cases of natural small-pox is very great indeed. Making every allowance for greater care being taken in Boston than in London, for instance that the cases of inoculation should not serve as causes of infection, these records afford very strong evidence in support of the view that, on the whole, inoculation did not, at least materially, increase the mortality from small-pox.

75. The general conclusion which may be drawn seems to be that inoculation had a double influence, one favourable, the other unfavourable, as regards small-pox; and, owing to the conflict between these two influences, it produced but little effect upon the prevalence of or mortality from small-pox.

There is no adequate evidence that inoculation did increase the mortality from small-pox. There was certainly, so far as the evidence goes, no such increase of small-pox, coincident in point of time with the increase of inoculation, as to justify the decrease of the latter being considered the main cause of the marked decline of the former. Nor is there sufficient even to show that it was a distinct subsidiary cause.

76. It is to be observed that some opponents of vaccination, whilst insisting that the decline in small-pox mortality in the first quarter of the present century was due to the discontinuance of the practice of small-pox inoculation, have contended that what was supposed to be vaccination during that period was in reality inoculation with small-pox virus. It is obvious that these theories are mutually destructive. If the so-called vaccination was in truth small-pox inoculation and the latter practice increases the prevalence of small-pox, the disease should have increased and not diminished during the period under review.

77. Another view has been put forward attributing the decline in question to the improvement of sanitary conditions.

78. The question how far the behaviour of small-pox in the eighteenth century and earlier was influenced by sanitary conditions, is one rendered difficult by the lack of exact information. We may distinguish between overcrowding as one insanitary condition and all other insanitary conditions, such as lack of cleanliness and the like. *A priori* we should expect that a dense population, especially one of great internal movement, and one in continual interchange with surrounding populations, by offering greater facilities for the conveyance of contagion, would lead to a greater amount of small-pox. London was a conspicuous instance of the above, and the apparent greater prevalence of small-pox in London than in the provinces may be attributed to these causes; but it would appear that the increase was felt, as indeed would, *à priori*, seem probable, rather in the constant presence of small-pox to a considerable amount at all times than in the mortality of the epidemics when these occurred. And the same seems also

to be shown to a less extent in other large cities, such as Liverpool. But in this matter of dense and moving populations the eighteenth century did not differ markedly from the early part of the nineteenth. We might *à priori* expect the other acknowledged imperfect sanitary conditions of the eighteenth century to increase the fatality of, and so to a corresponding extent the mortality from, small-pox; but there is no exact evidence to confirm this supposition. If on the contrary we recognise that in the course of the eighteenth century the general mortality, the relative number of deaths from all causes, went on decreasing, and attribute, as has been done, this decrease to improved sanitary conditions, no like decrease of small-pox took place. Again, the places which were deemed the most salubrious appear to have been visited by epidemics of small-pox as severe as those which fell on unhealthy places. Thus the epidemic in Chester in 1774 was undoubtedly a severe one, and yet Haygarth writes, "The "healthiness of Chester," as shown by statistics, "must appear so very extraordinary "as to be almost incredible." And in general both the incidence of, and mortality from, small-pox seem to have been far less affected by sanitary conditions than might *à priori* have been expected.

79. It may be urged against the view that the decline of small-pox was due to improved sanitary conditions, in the first place, that, admitting the introduction of sanitary improvements, no evidence is forthcoming to show that during the first quarter of the nineteenth century these improvements differentiated that quarter from the last quarter, or half, of the preceding century in any way at all comparable to the extent of the differentiation in respect to small-pox. In the second place, admitting *à priori* that crowded dwellings tend to increase the liability to contagion, and so the prevalence of the disease, while other insanitary conditions tend in addition to increase the fatality among those attacked, so that insanitary conditions as a whole must tend to increase the mortality from small-pox; no evidence is forthcoming which distinctly shows that the dependence of the prevalence of, or the mortality from, small-pox, on the lack of sanitary conditions, was a feature of the history of small-pox during the eighteenth century.

80. It has, indeed, been urged that the London Bills of Mortality show in respect to the heading "Fevers," a decline during the first quarter of the nineteenth century comparable to the decline of small-pox during the same period; that the former is to be explained by the improvements in sanitary conditions, and that, therefore, the latter is to be explained in the same way.

But it must be borne in mind that while there is no difficulty in recognising and naming the disease small-pox, so that the heading "Small-pox" in the Bills may be taken to have included very few cases which were not small-pox, and to have omitted very few which were; the case is very different with the heading "Fevers," the returns under which were so dependent on diagnosis and nomenclature, that a difference in these respects would produce a large change in the number of cases found under this heading, without any change in the actual disease or diseases themselves. Scarcely any heading in the Bills can be less safely trusted as an indication of the conditions affecting disease.

If we turn to some other diseases, as, for example, measles, we find no trace of the influence of sanitary improvements in the early part of this century as compared with the period preceding it. There was no decline of the mortality from that disease, but on the contrary an increase. Moreover, some of the diseases which contributed to the heading "Fevers" are dependent on sanitary conditions to an extent and in a manner wholly different from small-pox.

We shall return to this question hereafter, and discuss more fully the influence exercised by sanitary changes upon the mortality from small-pox.

81. Moreover, it must be remembered that the decline in small-pox mortality was observed in Western Europe in countries where the sanitary conditions were widely different. Whatever may have been the sanitary improvements during the first quarter of this century in England and some other countries, there seems no ground for supposing that throughout Western Europe the period was marked by great changes in the direction of improved sanitation. Indeed, in many countries down to a recent period, in some it may perhaps be said even to the present time, insanitary conditions have continued to prevail.

82. There is no proof that sanitary improvements were the main cause of the decline of small-pox under discussion. And no adequate evidence is forthcoming to show to what extent such improvements may be considered as a subsidiary cause.

83. The decline in question followed upon the introduction of the practice of vaccination. The records of Western Europe and the United States show that, in all places whence returns were obtained, the introduction of vaccination was followed by a decline of small-pox; the decline becoming especially apparent after the lapse of such time as may be supposed to be necessary for the due spread of the practice.

Moreover, the spread of the practice and the decline of the disease do not stand as two phenomena simply following the same course, but without any tie joining the two. The experimental evidence offered at the time, namely, that the class of vaccinated persons did not take small-pox, by way either of exposure to natural contagion or of inoculation, as the unvaccinated did, connects the two and points to the spread of the practice as the cause of the decline.

84. It has been suggested that the decline was due to some general unknown conditions, which have been spoken of as "cosmic" or "secular." It has been urged that such general "cosmic" conditions led, on the one hand, to the spread of small-pox in Europe during the seventeenth and especially during the eighteenth centuries, and, on the other hand, conversely to its decline in the beginning of the nineteenth century. The possibility of such general "cosmic" conditions influencing small-pox cannot be denied; but at present, at all events, the appeal to such conditions is the result, not of positive knowledge, but of our inability to explain the phenomena otherwise. Moreover, it is not certain that the relative paucity of small-pox in Europe before the seventeenth century was not apparent rather than real, being due merely to absence of information; if so, there is no necessity to seek in "cosmic" influences the cause of the supposed later increase.

In attempting to judge of the decline in question being due to such "cosmic" influences, we are met with the difficulty that exact records of the prevalence of small-pox during the period under discussion are wanting in respect to countries where vaccination was not practised. But such information as is available goes to show that in the countries where vaccination did not become general, small-pox prevailed in the first quarter of the nineteenth century very much as it had prevailed in the eighteenth. Thus, in Egypt vaccination was not introduced until 1827, and up to that time small-pox was extremely prevalent; the decline, which in Western Europe was marked during the first quarter of the century, appears to have been absent there. Again in America, though in the early days of vaccination efforts were made to spread the practice among the native tribes, these (especially the tribes of the West) remained unvaccinated, and among them the ravages of small-pox in the first quarter of the nineteenth century are described as of extreme severity. So in Brazil, vaccination though introduced early, was not carried on with the same energy as in Europe, and here severe epidemics of small-pox occurred. There is no adequate evidence of a decline in unvaccinated countries like that which took place in vaccinated countries, and there is no sound reason for attributing the latter to any theoretical "cosmic" influences.

6, App. 746, and Enclosure A., there referred to, at pages iii., iv., 9 and 23; 6, App. 747–9. 1, App. 63, footnote (last). 6, App. 742–4.

85. Upon the whole, then, we think that the marked decline of small-pox mortality in the first quarter of the present century affords substantial evidence in favour of the protective influence of vaccination.

86. It has been urged that the decline was too great to have been due to the amount of vaccination which prevailed. It has been shown, however, that the amount which was carried out was very considerable, and the argument that such an amount was insufficient to produce the decline in question is based on the premiss that such an amount of vaccination would at the present day be considered wholly insufficient protection. But it must be borne in mind that in the countries so often mentioned a large proportion of the population were protected by previous attacks of small-pox, either natural or inoculated; only a portion of the population needed the protection claimed for vaccination. And if the vaccination in the early years of the century was as general as we have seen reason to think it was, that, added to the protection

afforded by previous attacks of small-pox, may be regarded as adequate to have produced the decline in question.

Of course, as years went on, the proportion of the population immune through previous small-pox became, owing to the mere decline of small-pox, continually less and less, as the large number who had had the small-pox in the previous century gradually died out. After the first quarter of the century that part of the population which depended for immunity on vaccination alone became, in the absence of serious epidemics, greater and greater; and an amount of vaccination adequate to afford great protection in the earlier years ceased to be adequate for the latter years. But this brings us to the periods succeeding the first quarter of the century, which will be considered hereafter.

Does the history of small-pox mortality since vaccination was introduced afford warrant for a belief in its protective effect? (ii.) *The period since* 1825.

87. We have dealt thus with the evidence afforded by the first quarter of the present century, because it constituted a convenient epoch for inquiring whether mortality from small-pox had shown signs of diminution in the period immediately succeeding the introduction of vaccination, and not because the close of that quarter of a century was in any respect a dividing line. So far as England is concerned a new epoch commenced in 1837. There was nothing to distinguish the phenomena observable between 1825 and 1837 from those of the preceding years of the century, and the only mortality statistics in our possession relating to those intervening years became not more but less accurate and satisfactory.

88. In the year 1837, however, the present system of registration of deaths commenced in England, so that from that period more exact statistics of small-pox mortality are available. In Scotland a similar system of registration was not initiated until 1855, and in Ireland until 1864. In the latter country, however, information with reference to the mortality in preceding years was, prior to the registration of deaths, acquired when the decennial census was taken. This practice commenced at the period of the census in 1841.

89. Before proceeding to inquire what light the records of small-pox mortality in England, Scotland, and Ireland, during the years when more accurate information has existed as to small-pox mortality, throws upon the question of the effect of vaccination, it will be convenient to make a brief statement of the laws which have been from time to time passed with reference to that practice. This is important, because it has been argued that a connexion may be observed between the diminution of small-pox in the epochs subsequent to the different Acts passed by the Legislature, for the purpose of encouraging or compelling vaccination, and the increase of vaccination which would naturally result from those enactments.

Vaccination legislation in England and Wales.

90. Although the House of Commons had made grants to Jenner in 1802 and 1806, and annual grants to the National Vaccine Establishment, which was founded by Royal Warrant in the following year, no statute was passed dealing with the matter until the 23rd July 1840. On that day the Act 3 and 4 Victoria, chapter 29, entitled "An Act to extend the practice of vaccination," received the Royal Assent.

91. By that Act the Guardians and Overseers of every Parish or Union in England and Wales were empowered and they were thereby directed to contract with their medical officers or with any legally qualified medical practitioners for the vaccination of all persons resident in such Unions or Parishes respectively. Payments were to be made dependent on the number of persons who, not having been previously successfully vaccinated, should be successfully vaccinated by the contracting medical officer or practitioner. In making their arrangements Guardians and Overseers were by section 2 to conform to regulations made by the then existing Poor Law Commissioners, who had power conferred on them for the purpose. 1840

By the eighth section of this statute inoculation of the small-pox was declared to be illegal and the use of it was made penal.

The provisions of this Act were by its sixth section applied to Ireland.

92. In the next year, on the 21st June 1841 (4 & 5 Victoria, chapter 32), there was supplementary legislation (1) charging the expenses of carrying out the Act of 1840 on the poor rates and (2) enacting that "the vaccination, or surgical or medical assistance "incident to the vaccination of any person resident in any Union or Parish or of any "of his family should not be considered parochial relief," nor should he by reason "of

" such vaccination or assistance be deprived of any right or privilege or be subject " to any disability or disqualification whatever."

93. These Acts were repealed by the Consolidation Act of 1867, but the Act of 1840 is important historically as being the first of the series of Acts relating to vaccination; and especially so because of the terms of the eighth section forbidding inoculation; and, again, because it not only speaks of vaccination itself, but of surgical or medical assistance incident to the vaccination, which contemplates the duty of providing the surgical or medical assistance which the operation might render necessary or expedient, and the necessary expenditure in respect thereof.

94. It is to be further observed that in the legislation of 1840 and 1841 there was no compulsion on parents or others to procure or to submit to vaccination. The services of the vaccinator were to be provided, and he was to vaccinate all who might choose to come to him for that purpose. It is not clear whether re-vaccination was contemplated. Although there is a difference in the language of sections 2 and 6 relating to England and Wales and Ireland respectively, yet it is probable that, looking to the mode of payment provided in section 1, a second vaccination was not contemplated by the Act.

95. At the suggestion of the Epidemiological Society, which had been formed in 1850, Lord Lyttelton introduced into the House of Lords the measure which afterwards passed into law on the 20th August 1853 without opposition or division. This was really the first measure for compulsory vaccination. It is entitled "An Act to " extend and make compulsory the Practice of Vaccination." It applied only to England and Wales.

The principal provisions of this Act were as follows:—The Guardians and Overseers, when the Parishes were not in union, were required, subject to the approval of the Poor Law Board, to divide their Unions and Parishes into convenient districts (section 1) for the purpose of giving increased facilities for the vaccination of the poor. They were to appoint a convenient place for the attendance of the vaccinator, and to give notice of place and time when he would attend to vaccinate, and to inspect the progress of the vaccination. The vaccinations were limited to those persons only who had not already been successfuly vaccinated. It seems, therefore. that re-vaccination was not contemplated by this Act

The second section contains the compulsion. It was enacted that within *three* months of the birth the father or mother or, in the event of their death or inability, the person in charge of the child, within *four* months, should take the child to the appointed vaccinator, unless such parent or person should have obtained a certificate of previous vaccination from some other practitioner; and the vaccinator was required thereupon, or as soon after as it might be conveniently and properly done to vaccinate the child. It was enacted by the third section, "Upon the eighth day following vaccination the father, " &c., shall take or cause to be taken the child to the vaccinator for his inspection that " that he may ascertain the result of the operation." By the fourth section it was provided that the vaccinator was to give a certificate of successful vaccination to the father, &c., and to transmit a duplicate to the Registrar of Births and Deaths of the Sub-District in which the vaccination was performed. Section 5 made provision for children who in the opinion of any medical officer or practitioner were not in a fit and proper state to be successfully vaccinated. In such a case the medical officer or practitioner was to deliver a certificate to that effect, which was to remain good for two months and to be renewable from two months to two months until the child should be considered fit for vaccination, when it was to be taken to be vaccinated. So long as the certificate or its renewal should last, it was a sufficient defence against any complaint against the father, &c., for noncompliance with the Act.

The sixth section contained provisions for the payment to the Public Vaccinator of not less than 1*s.* 6*d.* when the vaccination was at the residence of the vaccinator or not more than two miles therefrom, and not less than 2*s.* 6*d.* if over two miles therefrom: and the seventh related to certificates of insusceptibility to the vaccine disease.

Then followed provisions as to the duties of the Registrar. The Registrar of the Sub-District was to keep a register of persons whose successful vaccination certificates had been transmitted to him by the vaccinator. By section 9 the Registrar was required on or within seven days from the registration of the birth of a child to send to the father, &c. notice in a given form, to take care that the child should be vaccinated, and of the time and place of the attendance of the vaccinator; and it was enacted that if after such notice the father, &c. of the child should not cause the child to be vaccinated or should not on the eighth day after vaccination take, or cause to be taken, the child for inspection, then the father, &c. should forfeit a sum not exceeding 20*s.* These penalties were recoverable before two Justices according to 12 Vict. c. 43., and paid into the funds for the relief of the poor.

96. The statute just referred to, though repealed, is notable by reason of a legal decision upon it which probably gave rise to an amendment of the law by a subsequent statute, out of which difficulties arose which will be shortly referred to. In the case of Pilcher *v.* Stafford, reported 4 Best and Smith, 775 : 33 L.J. (M.C.) 13, the Defendant had on the 18th February 1863 been convicted and fined 2*s.* 6*d.* on an information and summons brought before Magistrates by the Registrar for a breach of this Act, in not having after notice and within three months of the birth taken his child to the appointed vaccinator for vaccination. Subsequently, the child not having been vaccinated the Registrar brought a fresh information and complaint for the same cause. The Justices dismissed the information because they held that the offence of not taking the child to be vaccinated within the three months was a single definite offence, and that the Defendant having been once convicted and fined for this offence, it was contrary to law to convict and fine the Defendant a second time for the same offence.

The Court of Queen's Bench (Cockburn, Chief Justice, and Blackburn and Mellor, Justices) on this ground decided against the Registrar, and confirmed the decision of the Magistrates.

97. By an Act passed on the 1st August 1861 permission was given to Guardians and Overseers to appoint persons to institute and conduct proceedings for the purpose of enforcing obedience to the Vaccination Acts, and further enacting that proceedings might be taken at any time during which the parent remained in default, and that the expenses of prosecuting might be charged upon the poor rate. This statute is noteworthy, as by some persons a difference in results, favourable to vaccination, has been insisted upon, between the *permission* to appoint such persons and the *obligation*, afterwards imposed, to appoint them.

98. Attention must here be called to a statute of great importance in the administrative history of the Vaccination Laws. In the year 1858 an Act was passed with the short title of "The Public Health Act, 1858," and entitled in full "An Act for vesting in the Privy Council certain Powers for the Protection of the "Public Health." A Board, called the General Board of Health, had about 10 years before been constituted, and had had certain powers entrusted to it. The Board was appointed only to continue till the 1st of September 1858, and the Act now under consideration vested in the Privy Council, not only certain other duties and powers with reference to Public Health, but also certain special powers and duties with reference to the Vaccination Laws. It was enacted by the second section that the Privy Council might from time to time issue regulations as to the due qualification of persons to be thereafter contracted with by Guardians and Overseers under the Vaccination Acts, and for securing the efficient performance of vaccination by the persons with whom such contracts were made; and it was further enacted that money voted by Parliament for or towards defraying the expenses of the National Vaccine Establishment or otherwise providing for the supply of vaccine lymph should be applied under the direction of the Privy Council. Section 3 gave the Privy Council power to inquire generally as to matters concerning the Public Health, and particularly as to the observance of the regulations under the Act. For the purpose of aiding the Privy Council in the execution of their duties they were to have the power of appointing a medical officer and other persons. One of the principal duties (sections 5 and 6) of the medical officer was to report to the Privy Council generally upon health matters, and especially once a year on all proceedings taken under the Act. This report was to be presented annually to Parliament.

The Act also contained a provision that "penalties under the Vaccination Act might "be proceeded for by any Registrar, Public Vaccinator, or Officer authorised by the "Guardians and Overseers, and that the costs of such proceedings should be defrayed "out of the Common Fund of the Union or out of the Poor Rates of any Parish not "included in any Union."

99. This Act (which with the exception of its eighth section was made perpetual by the Statute 22 and 23 Vict. cap. 3), and the powers of the Privy Council conferred by it,

were practically administered under the Vice-President of the Committee of the Privy Council on Education.

The Poor Law Board still continued to exercise control over the form of the contracts between Guardians and Overseers with Public Vaccinators, but the Privy Council, with the aid of their medical officers, were charged with the duty of supervising the efficient performance of vaccination.

How this Act was administered by the Privy Council, their medical officer and their staff, is recorded in the annual reports presented and laid before Parliament by their medical officer in accordance with the Act.

The Privy Council continued to exercise jurisdiction under the Act of 1858, and [illegible] the Act of 1867 herein-after referred to until the Local Government Board Act, 1871, came into force. This vested in the new Board the powers which under the statutes of 1858 and 1867, the Privy Council had exercised.

100. The Act of 1867 (30 & 31 Vict. cap. 184) besides being a consolidating statute introduced some important additional provisions. The sections which it is important to notice contained the following provisions:—Sections 1 and 3 dealt with the division of the county into Vaccination Districts. This was to be done by the Guardians under the control of the existing Poor Law Board, to which body, in 1871, by virtue of the statute before referred to, the Local Government Board succeeded. The contracts and their form were also to be subject to the approval of the Poor Law Board. The Privy Council were authorised to pay to the Public Vaccinators additional sums to those which the Guardians and Overseers had to pay under their contracts. The intention of this clause appears to have been to enable the Privy Council to reward the Public Vaccinators for good and successful work and to stimulate their diligence and care in the performance of their duties. The following clause increased the remuneration to be allowed to Public Vaccinators to not less than 2*s.* where the vaccination was performed at more than a mile, but less than two miles, from the residence of the vaccinator, and to not less than 3*s.* where the vaccination was performed at a distance exceeding two miles.

By the eighth section provision for the encouragement of re-vaccination was specifically made by Parliament. The Privy Council was authorised to issue regulations in respect of the re-vaccination of persons who might apply to be re-vaccinated; and in that case the Guardians were required to pay fees for successful re-vaccinations performed in accordance with such regulations of an amount equal to two-thirds of the primary vaccination fees. It would appear from the language of this section that the wording of some existing contracts had included re-vaccination. By the eighth section, however, it was enacted that these contracts should not apply to re-vaccination upon the Act coming into operation.

The 16th section enacted as to every child born in England that within *three* months after the birth of such child or where by reason of the death, &c., of the parent, any other person should have the custody of such child within three months after receiving such custody, the parent or such person should take it or cause it to be taken to the Public Vaccinator . . . or should within such period cause it to be vaccinated by some medical practitioner. If the child were brought to a Public Vaccinator in compliance with the conditions in the Act he was required to vaccinate the child.

By section 17 it was enacted that upon the same day in the week following, in cases in which the operation was performed by the Public Vaccinator, the parent or person must again take the child to the vaccinator or his deputy, so that he might inspect the child and ascertain the result of the operation, and, if he should think fit, take from such child lymph for the performance of other vaccinations; in the event of the vaccination having been unsuccessful, the parent or other person was required, if the vaccinator so directed, to cause the child to be forthwith again vaccinated.

By section 27 a new and important provision was made with reference to the enforcement of the Act. This provision was repealed by the Act of 1871, and another scheme of legislation adopted to which future reference will be made. By this section it was enacted—"The Registrar of each District shall within one week after the first "day of January and the first day of July in each year make a list of all cases in "which certificates of vaccination have not been received by him during the preceding "half year, and shall submit the same to the next meeting of the Guardians for whom "he acts, and the said Guardians shall forthwith make enquiries into the circum-"stances of the cases, and if they find that the provisions of the Act have been "neglected, shall cause proceedings to be taken against the persons in default."

This section imposed a duty on the Guardians to prosecute, and section 28 provided for their expenses and authorised them to pay any officer appointed by them to prosecute persons charged with offences against the Act or otherwise to enforce its provisions. Provision for the appointment of such officers had been made by the Act of 1861, 24 & 25 Vict. c. 59., and their appointment was afterwards by the Act of 1871 made compulsory.

By section 29 it was provided as follows:—"Every parent or person having the custody "of a child who shall neglect to take the child or cause it to be taken to be vaccinated "or after vaccination to be inspected, and shall not render a reasonable excuse for his "neglect, shall be guilty of an offence, and be liable to be proceeded against summarily, "and upon conviction to pay a penalty not exceeding 20*s*." This clause was in substance a re-enactment of the clause in the Act of 1853 (section 9) upon which the case of Pilcher *v.* Stafford was decided, but it is important to refer to it again in connexion with the changes of the law contained in other sections of the Act.

A point of some importance has been raised with reference to the construction of section 29. It will be observed that it provides that every parent or person having the custody of a child who neglects to have the child vaccinated "and shall not render "a reasonable excuse for his neglect" shall be guilty of an offence and be liable to be proceeded against, and upon conviction to pay a penalty. It has been contended that this points to the reasonable excuse being rendered before proceedings are taken. There is much to be said for this contention. The parent "guilty of an offence" and "liable to be proceeded against" is one who neglects and shall not render a reasonable excuse for his neglect. The section does not say that the parent who, without reasonable excuse, neglects to have his child vaccinated shall be guilty of an offence, as one would expect if the intention were that the excuse should be rendered to the magistrate as a defence when proceedings have been instituted. The section is certainly so framed as to afford countenance to the contention we are considering. On the other hand, no body or person is indicated to whom an excuse can be rendered before the proceedings are instituted. There is no machinery provided for hearing and adjudicating upon excuses at that period and for giving a certificate that a reasonable excuse has been rendered to serve as a bar to further proceedings. On the whole, then, although it is not for us to express an opinion on the legal construction of the clause, which is very unhappily framed, it would probably be construed as intending that the excuse should be rendered to the tribunal before which proceedings for the neglect to vaccinate are pending.

We now come to the much-discussed section 31. It seems probable that section 31 was enacted for the very purpose of supplementing the provisions of section 29. Its purpose seemed to be to enable those who prosecuted (and this duty had by section 27 been imposed upon the Guardians) to follow the parent responsible for the vaccination so long as the child remained unvaccinated, and by penalties to compel the parent to do what according to the law was his duty. Nevertheless, no conviction could take place under this section without a previous order of a magistrate, and the first step in the transaction was to inform the magistrate and obtain a summons to the parent to appear with the child before him. Thereupon, when the parent appeared absolute discretion was left to the magistrate before whom the case was brought. He might or might not make the necessary order. If he did not, no further penalty could be inflicted. If he did and it was obeyed no penalty could follow. But if he did and it was disobeyed, one penalty alone could be inflicted for the disobedience. A further order must be made, and that order disobeyed before another penalty—not for disobedience to the first—but to the second order, could be inflicted. This is evident from the words of the section. The magistrate "may, if he "thinks fit"—words of absolute discretion—make an order for vaccination; and there is nothing in the section to bind the magistrate's discretion to refrain from making an order should he for any reason come to the conclusion that it was expedient to do so. The words of the section seem purposely framed to leave the discretion to the magistrate. It is true that if the order was once made and disobeyed, without the justification of one or other of the two matters of excuse mentioned in the section, the disobedience must be punished and the parent prosecuted (the words are "shall" be proceeded against), but the discretion was to be exercised before the order was made, and this discretion is left to the magistrate.

101. Accordingly it was held in the case of Allen and Worthy, reported L.R. 5, Q.B. 163, that, notwithstanding the principle laid down in Pilcher *v.* Stafford a second conviction could follow disobedience to a second order under the section just referred to. Lord Chief Justice Cockburn said, "I think that the intention of the Legislature "was not simply that a penalty should be imposed on a person once for all if he

" omitted to do that which, in the view of the Legislature, public health and safety " required, but that a penalty might be imposed so long as disobedience to its enact- " ments continued. I therefore hold that the powers given by section 31 are not " confined to one order and one conviction, but that the proceedings may be repeated " *toties quoties* so long as disobedience continues."

Another point arose in Allen *v.* Worthy which it is needless to refer to, for it can scarcely be supposed that as a matter of discretion a magistrate would make an order, if a *bonâ fide* certificate of unfitness, made less than two months before the order, was still in force.

102. There is no doubt that those magistrates who, in the exercise of their discretion, made repeated orders in respect of the same child, were in the opinion of many mistaken, and harsh results often followed, and the evidence of this, which was brought before them, doubtless led to the recommendation in the Report (dated 23rd May 1871) of the Select Committee of the House of Commons on the Vaccination Act (1867), that no more than two penalties or one full penalty should be imposed in respect of the same child.

103. It was also contended that persons convicted of disobedience to orders and committed to prison under this Act ought to have been treated as debtors and not as criminal prisoners. An action was brought against the officials of Portsmouth Gaol, in which a person who had been fined, and had been imprisoned on non-payment, was dealt with according to the ordinary prison rules and not as a debtor. Lord Justice, then Mr. Justice, Lindley tried the case at Winchester Assizes in January 1884, and afterwards, by a considered judgment in which he drew a distinction between a conviction imposing a fine and an order made for payment of money, held that in this case there was a breach of a statutory duty punishable by a fine, which was in the eye of the law a criminal offence. In the result he found the defendants had acted rightly in dealing with the plaintiff according to the prison rules applicable to criminal prisoners, and that the plaintiff had no legal right to be treated as a debtor. He gave judgment for the defendant with double costs. (Kennard *v.* Simmons, Cutt and Woods, Winchester Assizes, January 1889.)

104. The Act of 1867 remained unaffected by subsequent legislation until the 1st January 1872, when the Vaccination Act, 1871, came into force.

Meanwhile a Select Committee had been appointed to enquire into the working of the Act of 1867, and this Act of 1871 was introduced into the House of Commons by Mr. Forster, its chairman. The Act was entitled " an Act to amend the Vaccination " Act, 1867," and was to be construed as one with it.

A change of importance was made by the fifth section which rendered the appointment and payment of officers to prosecute and to enforce the provisions of the Acts obligatory upon the Guardians, whereas it had theretofore been permissive only. These officers were to be called Vaccination Officers. They were to perform all the duties imposed on the Registrars by the principal Act, except giving the notices to the parents within seven days of the registration of the births under section 15 of the Act of 1867.

By section 8 it was provided that every Registrar of Births and Deaths for any place should once at least transmit to each Vaccination Officer a return of all births and deaths of infants under 12 months of age, which, since the date of the last return had been registered by him. Section 9 deals with re-vaccination. It enacts that when the operation of re-vaccination is performed gratuitously by a Public Vaccinator on the application of any person, he shall deliver to such person a notice requiring him to attend for inspection, and if that notice is not complied with such person is rendered liable to pay to the Guardians a fee of 2*s.* 6*d.*

Section 10 imposes a fine of 20*s.* on any person who prevents a Public Vaccinator taking lymph from any child as provided by section 17 of the principal Act. Section 11 imposes a similar penalty on any parent who fails to produce a child when required by summons under section 31 of the principal Act. By the same section any complaint may be made and any information laid at any time not exceeding 12 months from the time when the matter of complaint or information arose, and not subsequently. This is a new provision as to limitation. There is a further provision as to re-vaccination in section 13 granting fees to the medical officer of the Union if, while attending as such medical officer upon a small-pox patient, he either (1) vaccinates a person who has never been vaccinated or had small-pox, or (2) re-vaccinates any person who is resident in the same house with the person sick of the small-pox, and has never been re-vaccinated, being of the age at which public re-vaccination is paid for to a Public Vaccinator under the regulations for the time being of the Privy Council.

105. By the joint effect of the Vaccination Act, 1874, the fifth section of the Vaccination Act, 1871, and the Local Government Act, 1871, the Local Government Board was clothed with the same powers with respect to the Guardians and Vaccination Officers in matters relating to vaccination as the Poor Law Board * possessed with regard to Guardians and Officers of Guardians in matters relating to the relief of the Poor, and had power to make rules and regulations, and it was enacted that all enactments relating to such powers and to such orders, rules, and regulations by the Poor Law Board * should apply, mutatis mutandis, to the Local Government Board, including rules, orders, and regulations prescribing the duties of Guardians and their Officers in relation to the institution and conduct of the proceedings to be taken for enforcing the provisions of the Vaccination Acts of 1867 and 1871, and the payment of the costs and expenses relating thereto; and rules, orders, and regulations under the Act of 1874 were to be deemed to be made under section 5 of the Act of 1871.

106. By the machinery thus introduced, provision was made in substitution for that contained in the 27th section of the Act of 1867, which was repealed by the Act of 1871; that section, as has been pointed out, imposed upon the Guardians the duty of prosecuting cases brought to their knowledge by the Registrar. The new machinery gives power to the Local Government Board to regulate this matter among others, and they have acted on this power.

107. The Bill as introduced by Mr. Forster, the Chairman of the Select Committee, contained a clause (1) so framed as to carry out the recommendation in the Report as to repeated prosecutions in the case of the same child. This was struck out in the House of Lords, the amendment being carried by eight votes against seven. When the Bill was returned to the Commons Mr. Forster at that period of the session felt compelled to accept the amendment, being anxious to pass the Bill.

108. One other point remains for notice arising under the Act of 1871. It is provided by section 11 that the defendant in any proceedings under the Acts of 1867 and 1871 may appear by any member of his family, or by any other person authorised by him in that behalf.

109. Such are the provisions of the Acts which have from time to time been passed with direct reference to the subject of vaccination. The legislation is founded on the assumption of its efficacy, and that its advantages are so manifest that it is the duty of the State to enforce it even by the imposition of penalties for its neglect.

110. It is obvious that the most important part of the work rests with the public authorities to whom the vaccination of the population has been entrusted, subject to the general control of the central authority.

111. The superintendence, direction, and inspection of the work of vaccination was vested in the Privy Council in accordance with the terms of the Act of 1858 and the Act of 1867. Since 1871 the duties have been transferred to the Local Government Board.

112. How this part of the work of the Local Government Board is now carried on, and how it has been carried on since 1871, will be found in the evidence of Dr. Thorne Thorne. Q. 3834–4010.

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* The Poor Law Commissioners were constituted by the 4 & 5 Wm. 4. c. 76. By the 10 & 11 Vict. c. 107. another Commission with similar powers was appointed, the name of which was changed by 12 & 13 Vict. c. 103. sec. 21 to the Poor Law Board. By sec. XV. of 4 & 5 W. 4. c. 76. the Commissioners had powers conferred on them to make and issue orders, rules, and regulations for the guidance "and control of all" Guardians, Vestries, and Parish Officers so "far as relates to the management or relief of the poor and the "keeping, etc., of accounts, and making and entering into contracts in all matters relating to such manage- "ment or relief." By sec. 41 the Commissioners were empowered "to make orders to direct Guardians to "appoint paid officers for superintending or assisting in the administration and relief and employment of the "poor, and to direct the execution of the duties of such officers."

Q. 4011–266. Q. 4267–307.

Mr. Farn and Dr. Cory also in their evidence describe how vaccination is practised under the supervision of the Local Government Board and its officers.

113. With regard to proceedings by way of prosecution, the following order as to repeated prosecution has been made under section 5 of the Act of 1871 and the Act of 1874, viz., the Order of the 31st October 1874, sections 16 and 17, which are explained by the letter of the Local Government Board to the Evesham Guardians of the 17th September 1875. The 16th section of the Order is clear in its terms, that the Guardians shall in all cases in which the provisions of the Vaccination Acts for enforcing vaccination have been neglected, cause proceedings to be taken against the persons in default, and for this purpose shall give directions to the Vaccination Officer to institute and conduct such proceedings, but no such directions shall authorise the Vaccination Officer to take further proceedings under section 31 of the Vaccination Act, 1867, in any case in which an order has been already obtained and summary proceedings taken under that section until he shall have brought the circumstances of the case under the notice of the Guardians and received their special directions therein. Article 17 is to the effect that the Vaccination Officer shall take such proceedings as may be necessary under the Vaccination Acts in any case in which the Local Government Board desire him to do so.

114. With regard to the Statute Law relating to vaccination in Ireland and Scotland it is not necessary to state it at length for it is founded on the English Law. It will suffice to indicate generally the scheme of the Acts and point out any special provisions or differences.

Vaccination legislation in Ireland.

115. First as to Ireland. The earliest legislation for Ireland in respect to vaccination is contained in the two Acts of 1840 and 1841, which applied equally to England and Wales and Ireland; they have been already set out sufficiently. It will be remembered that by the Act of 1840 the practice of small-pox inoculation is forbidden and made punishable by imprisonment.

116. The first statute specially dealing with Ireland only in the matter of vaccination was the 14th & 15th Vict. cap. 168. section 13. By that statute the medical officer of every district in Ireland constituted under that Act was required to vaccinate every one coming to him for that purpose, subject to regulations of the Poor Law Commissioners for Ireland; and in 1858, by 21 & 22 Vict. c. 64., the Committee of Management for each Dispensary District in Ireland was required to divide their District into Vaccination Districts, subject to the approval of the Poor Law Commissioners. The Committee were to require the medical officer at each District to attend at some convenient place within the District to be approved by the Committee at such times as they should approve; and the medical officer was required to vaccinate all persons resident in his District who might come to him for that purpose, or whom he might be requested to vaccinate, being fit subjects for vaccination, subject to any such regulations as might be fixed by the Poor Law Commissioners; the medical officer was to report as to the number of persons successfully vaccinated by him in each year, and the payments were to be charged to the divisions comprising such dispensary, as all other medical relief was charged.

117. In 1863, by the 26 & 27 Vict. c. 52., vaccination was made compulsory, and by section 1 parents and guardians of children born in Ireland after 1st January 1864 were required within six calendar months to take them to the medical officer of the District to be vaccinated, who was required to vaccinate them.

By section 2 parents and guardians were required to take the child again on the eighth day following the vaccination to the medical officer for inspection.

Similar provisions are made with reference to certificates as to children unfit for vaccination, and as to the insusceptible as in the English statute of 1853.

One shilling was under this Act the appointed fee for the medical officer for a successful vaccination.

By section 8 a similar provision to that of the English Act was made (except that the period of birth was fixed at six months instead of three), for notice being given by the Registrar to the parents of the duty to vaccinate, and imposing a fine of 10*s.* on the parent or guardian who might be in default in not carrying the child to be vaccinated, or in not taking it for inspection.

By section 13 the Guardians of any Union in Ireland were authorised to direct proceedings against defaulters, and it was enacted that such proceedings might be taken at any time during default.

118. By a short Act passed in 1868 (31 & 32 Vict. c. 87.) it was enacted that the vaccination or surgical or medical assistance incident thereto should not be considered as parochial relief, and, in the words of the English Act, the practice of inoculation with variolous matter was made penal. (in Ireland)

119. In 1878 a section similar in effect and almost in words to section 31 of the English Act of 1867 was introduced into the Public Health Act for Ireland passed in the year 1878. It is striking evidence of the importance then attached to the provisions of that section by the Legislature that they introduced it into the Irish Code of Sanitary Law.

120. In 1879 an Act (42 & 43 Vict. c. 70.) to amend the Acts relating to vaccination in Ireland was passed whereby the age within which children were to be brought for vaccination was altered to three months, thus assimilating the law to that in force in England; and the provisions as to bringing the child for inspection on the eighth day following vaccination were re-enacted, and it was added as an additional reason for this, that, if the Vaccinator thought fit, he might take lymph from the child for the performance of other vaccinations; these amendments being taken from the English statutes.

By section 6 the vaccination fee was raised to 2*s.* and not only in the case of successful vaccination but also of re-vaccination; provided that the Vaccinator had made his report to the Committee of Management as required by the 21 & 22 Vict. c. 64.

By section 7 penalties of 20*s.* were imposed (1) on persons preventing any dispensary medical officer from taking lymph from a child as provided by section 4; (2) failing to produce a child when required by any summons under the Acts; (3) upon every parent or person having custody of a child who should neglect to produce it for vaccination or inspection as provided.

It was also provided by this section that a defendant in proceedings under the Vaccination Acts might appear by any member of his family or any person authorised by him.

These provisions were similar to those of the English Acts.

By section 10 it was enacted that the Guardians of any Union in Ireland might direct proceedings for the purpose of enforcing obedience to the Vaccination (Ireland) Acts; and the medical officers of the Dispensary District who might be required to attend and did attend were to receive pay not exceeding a guinea a day.

There are also contained in these Acts provisions as to certificates, returns, and registration, mutatis mutandis, similar to those in the English Acts.

121. The Vaccination (Ireland) Acts now in force are 21 & 22 Vict. c. 64., 26 & 27 Vict. c. 52., 31 & 32 Vict. c. 87., and 42 & 43 Vict. c. 70.; except sections 1, 2, 3, and 13 of 26 & 27 Vict. c. 52., which are repealed by section 13 of 42 & 43 Vict. c. 70. The other Acts mentioned above are inserted as part of the history of vaccination legislation for Ireland.

122. The mode in which the Vaccination Law in Ireland is administered will be found in the evidence of Sir F. MacCabe and of Dr. Grimshaw. Q. 3033-151; 2687-3032.

Vaccination legislation in Scotland.

123. The Law of Vaccination in Scotland is really comprised in one statute passed in 1863—26 & 27 Victoria chapter 108—and entitled "An Act to extend and make "compulsory the Practice of Vaccination in Scotland."

After reciting that it was expedient to extend and in certain cases to make compulsory the practice of vaccination in Scotland, and to make further provision for the vaccination of the Poor, the Act by its first section enacted that within two months after the passing of the Act the Parochial Board of any Parish or combination of Parishes in Scotland should appoint a registered practitioner to be the vaccinator within such Parish or Combination.

By section 3 the remuneration to the vaccinators is made to depend on the number of persons not previously vaccinated who have been successfully vaccinated by each vaccinator, varying, as in the English Act, according to distance, between 1*s.* 6*d.* and 2*s.* 6*d.*

By section 4 notice must be given by the Parochial Board of the appointment and name of each vaccinator to the Board of Supervision, the Registrar-General, and the Registrar for the District.

By section 5 the Parochial Board, and every vaccination and other officer, were to exercise their functions in conformity with the regulations from time to time issued by the Board of Supervision, and which it was authorised and required to make.

By section 6 provision was made for payment, from the rates and grant for medical treatment of the poor, of the expenses incurred in the execution of the Act, and by section 7 it was provided that the vaccination or any surgical or medical treatment incidental to it should not be considered parochial relief, and should not affect the parochial settlement.

By section 8 the duty was imposed on parents or persons having custody of any child, within six months of the birth, to cause it to be vaccinated by a medical practitioner, and a certificate of the vaccination was to be given to the parents and by them transmitted to the Registrar and registered by him.

Then followed similar provisions to those in the English Acts (section 9) for the case of children not in a fit state to be vaccinated, and of those who are (section 10) insusceptible. Similar provisions were also (section 11) made imposing on the Registrar the duty of delivering to any person registering the birth of a child a notice of the duty to vaccinate, with copies of the certificates in the schedule.

Section 12 made provision for the special dealing with Insular, Highland, and other Districts on the application of the Parochial Boards to the Board of Supervision, who might appoint a medical practitioner to travel through the districts to vaccinate.

Then followed certain provisions for the registration of vaccinators, and by the 17th section penalties not exceeding 20*s.* were imposed upon parents if they did not within 10 days of notice from the Registrar send in a certificate of the vaccination or its postponement, and failing payment the defaulters might be committed for a term not exceeding 10 days.

The 18th section imposed the duty on the Registrar once in every six months to transmit to the Inspector of the Poor of the Parish or Combination in which the District was situate a list of such persons as had failed to transmit or lodge a certificate of vaccination in terms of the Act. This list was to be laid before the Parochial Board, which was required to issue an order to vaccinate the persons named in the list. Notice of the order was then directed to be given to the parents or persons having the custody of the children, and in pursuance of the order the Vaccinator was required to vaccinate the persons named therein at a time not less than 10 days or more than 20 days after the date of the notice; and if any person or parent should refuse to allow the operation to be performed, such person or parent was to be liable to a penalty not exceeding 20*s.*, and failing payment to be imprisoned for a period not exceeding 10 days. It was subsequently held by the Court of Session in Scotland that the section permitted repeated prosecutions so long as the child or person remained on the list. 6, App. 653–4.

Provisions were then made by sections 19 to 23 as to certificates and registration, which need not be particularized.

Section 24 prohibited under a penalty inoculation with variolous matter or by wilful exposure to any variolous matter, or anything infected with small-pox, or wilfully by any other means producing the disease of small-pox in Scotland.

Section 25 dealt with the recovery of penalties. It provided that the warrant for imprisonment should specify the amount of penalty and expenses, and also specify a period (not exceeding in any case two months) at the expiration of which the party should be discharged notwithstanding such penalty or expenses should not have been paid. By section 26 proceedings might be taken at any time during default, and that section provided that the penalty should be awarded to the support of the poor.

An important section, the 27th, enacted that wherever the Parochial Board should fail to do or perform any of the acts or duties by the Act required of them, it should be lawful for the Board of Supervision without prejudice to the right to compel performance thereof, to do and perform the same, and the acts of the Board of Supervision should be as valid and effectual as if done or performed by the Parochial Board.

124. This Act is the only one now in force in Scotland with direct reference to vaccination, except that by a section (57) of the Public Health (Scotland) Act, 1867, the local authority under that Act may defray the cost of vaccinating such persons as to them may seem expedient not being children of paupers or persons ordered to be vaccinated in terms of the 18th section of the Act 26 & 27 Vict. c. 108.

125. By section 5 of the Secretary for Scotland Act, 1885 (48 & 49 Vict. c. 61.), all powers vested in or imposed on one of Her Majesty's Principal Secretaries of State, or by the enactments mentioned in Part One of the Schedule to the Act, are transferred to the Secretary of State for Scotland created by the Act. Among the Acts mentioned in the Schedule is the Vaccination (Scotland) Act, 1863 (26 & 27 Vict. c. 108.).

Under the provisions of the Local Government (Scotland) Act of 1894, the Local Government Board for Scotland has been substituted for the Board of Supervision and Parish Councils for the Parochial Boards; but, except in this substitution, no alteration has been made in the legislation as to vaccination.

126. Details of the mode in which the vaccination law of Scotland is administered will be found in the evidence of Mr. John Skelton, then Chairman of the Board of Supervision. Both the statute law and the method of administration differ very materially from those which prevail in this country. Some of the points of difference in the two systems have so material a bearing upon questions submitted to us for report that it will be well here to call attention to them. An official vaccinator is appointed by each Parochial Board. Beyond the vaccination of paupers and the children of paupers, however, his duty is confined to vaccinating defaulters. The great majority of vaccinations in Scotland are performed by private medical practitioners at the expense of the parent or guardian. In all cases in which certificates are not received by the Registrar of compliance with the requirements of the Act, the names are inserted in a list of defaulters sent every six months to the Parochial Board. It then becomes the duty of that Board to see that these defaulters are vaccinated. They go through the list transmitted to them and notify to the parent or guardian of each child that its name is contained in the list, and that if not privately vaccinated it will be vaccinated by the official vaccinator.* The Parochial Board issue an order to the vaccinator to vaccinate the persons named in the list not less than 10 days nor more than 20 after the date of the notice to the parent or guardian. A large number of the defaulters are privately vaccinated in consequence of these notices before the visit of the official vaccinator. If this has not been done the vaccinator calls on each of the defaulters and offers to vaccinate. If the parent's consent is obtained the child is vaccinated; if consent is refused, a certificate is given stating the fact and the ground of refusal. Any other reason for not vaccinating a child, such as insusceptibility, previous vaccination, or condition of health, is also embodied in a certificate. The power conferred upon local authorities under the Public Health Act by section 57 of that Act to afford gratuitous vaccination appears to be exercised chiefly when epidemics are present within the district of the local authority. A house-to-house visitation is often made by medical men appointed for the purpose, and a large number of re-vaccinations are thus effected. The distinguishing feature of the Scotch system which deserves special attention is that the operation is carried out in almost all cases at the house where the vaccinated person is residing. The official vaccinator visits the case there after an interval of eight days to see whether the operation has been successful. Although he pays no visit in the interval he would often be sent for if any untoward symptoms presented themselves, inasmuch as the official vaccinator is in ninety-nine cases out of a hundred the officer whose duty it is to afford medical assistance to the poor. Q. 278,84-28,110.

127. We have now to consider the records of small-pox mortality in the United Kingdom since the time when the number of deaths and their causes came to be accurately registered, to inquire into the prevalence and progress of the practice of vaccination during the same period, and to see how this evidence bears upon the question whether vaccination exercises a protective influence against small-pox. *Influence of spread of vaccination on small-pox mortality.*

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* *As stated in § 125, the Parish Council has now taken the place of the Parochial Board.*

*In England and Wales.**

128. The following table shows the mortality from small pox in England and Wales during each of the years 1838–1842 and 1847–1894. The figures for the years 1843–1846 are not available.

1, App. 114 5, 6, App. 779.

Year.	*Population.*	*Number of Deaths from Small-pox (with those returned as from Chicken-pox).*	Deaths from Small-pox (with those returned as from Chicken-pox) to every 100,000 living.	Year.	*Population.*	*Number of Deaths from Small-pox (with those returned as from Chicken-pox).*	Deaths from Small-pox (with those returned as from Chicken-pox) to every 100,000 living.
1838	*15,287,699*	*16,268*	106	1867	*21,677,525*	*2,513*	12
1839	*15,514,255*	*9,131*	59	1868	*21,948,713*	*2,052*	9
1840	*15,730,813*	*10,434*	66	1869	*22,223,299*	*1,565*	7
1841	*15,929,492*	*6,368*	40	1870	*22,501,316*	*2,620*	12
1842	*16,130,326*	*2,715*	17	1871	*22,738,594*	*23,126*	102
1843	*16,332,228*	Causes of death not abstracted by Registrar-General.		1872	*23,096,495*	*19,094*	82
1844	*16,535,174*			1873	*23,408,556*	*2,364*	10
1845	*16,739,136*			1874	*23,724,834*	*2,162*	9
1846	*16,944,092*			1875	*24,045,385*	*952*	4
1847	*17,150,018*	*4,227*	25	1876	*24,370,267*	*2,518*	10
1848	*17,356,882*	*6,903*	40	1877	*24,699,539*	*4,395*	18
1849	*17,564,656*	*4,644*	26	1878	*25,033,259*	*1,970*	8
1850	*17,773,324*	*4,665*	26	1879	*25,371,489*	*631*	3
1851	*17,982,849*	*6,997*	39	1880	*25,714,288*	*754*	3
1852	*18,193,206*	*7,320*	40	1881	*26,046,142*	*3,231*	12
1853	*18,404,368*	*3,151*	17	1882	*26,334,942*	*1,439*	5
1854	*18,616,310*	*2,808*	15	1883	*26,626,949*	*1,056*	4
1855	*18,829,000*	*2,525*	13	1884	*26,922,192*	*2,363*	9
1856	*19,042,412*	*2,277*	12	1885	*27,220,706*	*2,936*	11
1857	*19,256,516*	*3,936*	20	1886	*27,522,532*	*368*	1
1858	*19,471,291*	*6,460*	33	1887	*27,827,706*	*593*	2
1859	*19,686,701*	*3,848*	20	1888	*28,136,258*	*1,142*	4
1860	*19,902,713*	*2,749*	14	1889	*28,448,239*	*106*	·4
1861	*20,119,314*	*1,320*	7	1890	*28,763,673*	*111*	·4
1862	*20,371,013*	*1,628*	8	1891	*29,082,585*	*140*	·5
1863	*20,625,855*	*5,964*	29	1892	*29,405,054*	*554*	2
1864	*20,883,889*	*7,684*	37	1893	*29,731,100*	*1,584*	5
1865	*21,145,151*	*6,411*	30	1894	*30,060,763*	*928*	3
1866	*21,409,684*	*3,029*	14				

129. In order to make the figures in the above table comparable throughout, we are obliged to include with the deaths returned as from small-pox those returned as from

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* The table given in § 128 is for England and Wales, including the metropolis. When considering the earlier statistics of small-pox mortality, we had in the absence of figures relating to the whole country to confine ourselves, in the main, to the material to be obtained from the old London Bills of Mortality. Accordingly, though it must be remembered that the area of London for registration purposes is a much larger one than that covered by the old Bills of Mortality, the following table, which shows the mortality from small-pox in registration London during each of the years 1838–1894, may be of interest. (The figures relating to the last eleven years of the table include the deaths, of London residents, in the Metropolitan Asylums Board's hospitals situated outside London.)

Year.	*Population.*	*Number of deaths from Small-pox.*	Deaths from Small-pox to every 100,000 living.	Year.	*Population.*	*Number of Deaths from Small-pox.*	Deaths from Small-pox to every 100,000 living.
1838 - - -	*1,766,169*	*3,817*	216	1867 - - -	*3,085,971*	*1,345*	44
1839 - - -	*1,802,751*	*634*	35	1868 - - -	*3,131,160*	*597*	19
1840 - - -	*1,840,091*	*1,235*	67	1869 - - -	*3,176,308*	*275*	9
1841 - - -	*1,878,205*	*1,053*	56	1870 - - -	*3,221,394*	*973*	30
1842 - - -	*1,917,108*	*360*	19	1871 - - -	*3,267,251*	*7,912*	242
1843 - - -	*1,954,041*	*438*	22	1872 - - -	*3,319,736*	*1,786*	54
1844 - - -	*2,033,816*	*1,804*	89	1873 - - -	*3,373,065*	*113*	3
1845 - - -	*2,073,298*	*909*	44	1874 - - -	*3,427,250*	*57*	2
1846 - - -	*2,113,535*	*257*	12	1875 - - -	*3,482,306*	*46*	1
1847 - - -	*2,202,673*	*955*	43	1876 - - -	*3,538,246*	*736*	21
1848 - - -	*2,244,837*	*1,620*	72	1877 - - -	*3,595,085*	*2,551*	71
1849 - - -	*2,287,302*	*521*	23	1878 - - -	*3,652,837*	*1,417*	39
1850 - - -	*2,330,054*	*499*	21	1879 - - -	*3,711,517*	*450*	12
1851 - - -	*2,373,081*	*1,062*	45	1880 - - -	*3,771,139*	*471*	12
1852 - - -	*2,416,367*	*1,159*	48	1881 - - -	*3,824,980*	*2,367*	62
1853 - - -	*2,459,899*	*211*	9	1882 - - -	*3,862,956*	*430*	11
1854 - - -	*2,503,662*	*694*	28	1883 - - -	*3,901,309*	*136*	3
1855 - - -	*2,547,639*	*1,039*	41	1884 - - -	*3,940,042*	*1,236*	31
1856 - - -	*2,591,815*	*531*	20	1885 - - -	*3,979,160*	*1,419*	36
1857 - - -	*2,636,174*	*156*	6	1886 - - -	*4,018,666*	*24*	·6
1858 - - -	*2,680,700*	*242*	9	1887 - - -	*4,058,565*	*9*	·2
1859 - - -	*2,725,374*	*1,158*	42	1888 - - -	*4,098,860*	*9*	·2
1860 - - -	*2,770,181*	*898*	32	1889 - - -	*4,139,555*	*0*	0
1861 - - -	*2,815,101*	*217*	8	1890 - - -	*4,180,654*	*4*	·1
1862 - - -	*2,860,117*	*366*	13	1891 - - -	*4,222,157*	*8*	·2
1863 - - -	*2,905,210*	*1,996*	69	1892 - - -	*4,264,076*	*41*	1
1864 - - -	*2,950,361*	*547*	18	1893 - - -	*4,306,411*	*206*	5
1865 - - -	*2,995,551*	*640*	21	1894 - - -	*4,349,166*	*89*	2
1866 - - -	*3,040,761*	*1,391*	46				

chicken-pox, the Registrar-General not having distinguished between such returns in his abstracts for the years 1838–1842 and 1847–1854. In this connexion, however, the inclusion or exclusion of deaths returned as from chicken-pox makes no material difference; the number of deaths at all ages so returned being but small, in comparison with the deaths at all ages returned as from small-pox, except as regards the years 1889, 1890, and 1891, when the small-pox mortality was very small. Q. 348. 1, App. 115. 6, App. 779.

Had the number of deaths returned as from chicken-pox been large enough to affect to any material extent the figures in the table, we should have excluded these deaths so far as we were able, though we think it possible and even probable that some of them may have been mistaken cases of small-pox. It is highly improbable that the number of such cases was considerable, seeing that, since deaths from chicken-pox have been separately recorded, the number of them has been small and approximately the same, year by year, whether small-pox was prevalent or not.

130. There exist no figures, comparable throughout the period 1838–1894, by which we can measure the extent to which, at one time as compared with another, the practice of vaccination prevailed in England and Wales in those years. That there has been, speaking generally, during that period a large spread of the practice is beyond doubt. We have given an account of the legislation from time to time enacted to this end, and we shall therefore merely recapitulate here the dates of the principal Acts of Parliament relating to the practice of vaccination in England and Wales which have come into force during this period.

> In 1840–1 the means of vaccination were provided at the expense of the Poor Rates for every person in England and Wales.
>
> In 1853 the practice of vaccination was made compulsory in regard to children born in England or Wales after the 1st August 1853, and penalties were imposed for non-compliance. The provisions for this purpose then enacted were found in working to be very imperfect; and, indeed, the obligation to be vaccinated remained little more than nominal down to the date of the appointment of paid Vaccination Officers. At the same time, however, the fact that the law required vaccination within a prescribed period from birth no doubt increased the spread of the practice. Q. 682. Q. 682–3; 692.
>
> In 1867 the laws relating to vaccination in England and Wales were consolidated and amended; and the provisions then enacted, as regards those Unions where the power given to appoint paid Vaccination Officers was exercised, were such as to make effective the obligation to be vaccinated. In many Unions, however, this power was not at once exercised. From the evidence taken by the Select Committee of the House of Commons in 1871 it appears that of 260 Unions inspected by the Medical Department of the Privy Council in the course of the year 1870, two years and more after the Act of 1867 had come into force, 121 were reported as not having at the date of inspection appointed Vaccination Officers, and 127 as having made such appointments, there being no report on the point as to the remaining 12 Unions (Appendix No. 15 to the Committee's Report); and in May 1871 Dr. Seaton informed the Committee that there were still a great many Unions in which Vaccination Officers had not been appointed (Question 5499). Q. 683.
>
> In 1871 the Act of 1867 was amended by making the appointment of paid Vaccination Officers compulsory in all Unions, by simplifying and improving the arrangements for the registration of vaccination, and in other ways. The effect of the amending Act towards increasing the spread of vaccination would be thus more marked in Unions where the power to appoint paid Vaccination Officers had not before its enactment been exercised; but the amendment of the law as to the registration of vaccination was such as to render it, in every Union, less likely that the obligation to be vaccinated would be evaded. Q. 31-5.

131. The records kept under the Vaccination Act of 1871, and tabulated by the Local Government Board, show the amount of primary vaccination, performed within a

certain period of birth, of children whose births were registered in England or Wales during the years 1872–1893. The following table gives the figures :—

6, App. 775.

Year.	Births registered during Year.	Of the Children whose Births were registered during the Year given in the First Column, by the 31st January in the Year next but one following that Year there were:						
		Successfully vaccinated.	Certified as insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed by Medical Certificate.	Remaining.	The Children not finally accounted for (including cases postponed) being Per Cent. of Births.
1872 - - - - -	821,856	698,137	1,693	905	78,594	42,527		5·1
1873 - - - - -	826,508	704,666	942	86	80,512	4,264	36,038	4·8
1874 - - - - -	854,787	727,065	920	96	85,325	5,677	35,704	4·8
1875 - - - - -	850,354	722,466	838	38	86,673	5,914	34,425	4·7
1876 - - - - -	887,694	763,277	848	107	84,930	5.528	33,004	4·3
1877 - - - - -	887,947	766,824	926	118	79,497	6,681	33,901	4·5
1878 - - - - -	891,743	760,982	840	44	87,936	6,475	35,466	4·7
1879 - - - - -	880,222	756,835	742	26	78,478	6,670	37,471	5·0
1880 - - - - -	881,652	750,203	859	46	87,361	5,930	37,253	4·9
1881 - - - - -	883,744	765,162	1,017	81	77,471	6,302	33,711	4·5
1882 - - - - -	889,082	763,525	993	45	81,498	7,598	35,423	4·8
1883 - - - - -	890,780	762,080	1,012	93	81,955	8,110	37,440	5·1
1884 - - - - -	906,581	764,975	1,363	81	90,134	8,693	41,335	5·5
1885 - - - - -	894,263	757,714	1,278	42	83,686	9,323	42,220	5·8
1886 - - - - -	903,846	754,059	1,278	20	90,774	10,187	47,528	6·4
1887 - - - - -	886,198	733,980	1,556	27	87,827	10,402	52,406	7·1
1888 - - - - -	879,813	719,103	1,888	12	83,287	12,282	62,701	8·5
1889 - - - - -	885,909	707,161	1,758	2	88,995	13,366	74,627	9·9
1890 - - - - -	875,188	682,560	1,672	2	91,768	13,615	85,571	11·3
1891 - - - - -	914,079	693,117	1,806	9	96,351	13,823	108,973	13·4
1892 - - - - -	890,695	663,657	1,983	26	92,490	13,278	119,261	14·9
1893 - - - - -	914,557	661,513	3,394	39	102,442	13,845	133,324	16·1

From these figures it may be inferred that, as regards those children whose births were registered during each of the years 1872–1883, the proportion primarily vaccinated remained practically the same. The effect of the opposition to the practice of vaccination, which in some parts of the country has grown of recent years (though to some extent at all events it has existed in England during the whole period now dealt with), is shown by the gradual diminution of the proportion primarily vaccinated in the case of children whose births were registered in England or Wales during each of the ten years 1884–1893. The diminution of this proportion did not, of course, necessarily result at once in a diminished proportion of the population who had, at some time in their lives, been vaccinated.

132. The materials before us do not allow us to make any numerical statement of the proportion, as time went on, during the period 1838–1894, of the population of England and Wales who had at some time been vaccinated. So far as we can judge of the effect of the efforts made during that period to extend the practice of vaccination, the proportion of the population who had at some time been vaccinated has steadily grown, though with no even rate of increase, during the years from 1840 onwards, down to a recent date at all events. The rate of increase was greater in 1853 and the few years immediately following it than in previous years and again expanded, still more considerably, in the years from 1868 to 1872 and perhaps in some few succeeding years.

133. Speaking generally of the period since 1838, there has been, as the table given in § 128 clearly shows, a marked though irregular decline in the death-rate from small-pox.

It may be well, too, to note at once a striking feature of this decline. During the period 1838–1894 the decline in the death-rate at all ages from small-pox has not been shared alike by the population at every age. While the decline in the death-rate of the population under ten years of age has been even more marked than the decline shown by the table in § 128 in the death-rate at all ages, there has been amongst the population over ten years of age a far less marked decline or, at certain of the higher ages, an actual increase in the death-rate. We shall have presently (§§ 168–201) to discuss fully this question of the altered age incidence of fatal small-pox both in England and Wales and in Scotland and Ireland.

In Scotland. 134. The following table shows the mortality* from small-pox in Scotland during each of the years 1855–1894 :—

6, App. 632.

Year.	*Population.*	*Number of deaths from Small-pox (with those returned as from Chicken-pox).*	Deaths from Small-pox (with those returned as from Chicken-pox) to every 100,000 living.*	Year.	*Population.*	*Number of deaths returned from Small-pox only.*	Deaths returned from Small-pox *only* to every 100,000 living.*
1855	*2,978,065*	*1,309*	48	1877	*3,590,022*	*38*	1
1856	*2,995,771*	*1,306*	46	1878	*3,628,268*	*4*	·1
1857	*3,012,310*	*845*	30	1879	*3,665,443*	*8*	·2
1858	*3,027,665*	*332*	11	1880	*3,705,994*	*10*	·3
1859	*3,041,812*	*682*	24				
1860	*3,054,738*	*1,495*	51	1881	*3,742,564*	*19*	·5
				1882	*3,770,657*	*3*	·1
1861	*3,069,404*	*766*	26	1883	*3,798,961*	*11*	·3
1862	*3,097,009*	*426*	14	1884	*3,827,478*	*14*	·4
1863	*3,126,879*	*1,646*	55	1885	*3,856,307*	*39*	1
1864	*3,156,021*	*1,741*	58	1886	*3,885,155*	*24*	·6
1865	*3,185,437*	*383*	12	1887	*3,914,318*	*17*	·4
1866	*3,215,129*	*200*	6	1888	*3,943,701*	*3*	·1
1867	*3,245,098*	*100*	3	1889	*3,973,305*	*8*	·2
1868	*3,275,350*	*15*	·5	1890	*4,003,132*	*0*	0
1869	*3,305,885*	*64*	2				
1870	*3,336,707*	*114*	3	1891	*4,033,180*	*0*	0
				1892	*4,063,452*	*11*	·3
1871	*3,368.921*	*1,442*	44	1893	*4,093,959*	*68*	2
1872	*3,404,798*	*2,448*	74	1894	*4,124,691*	*129*	3
1873	*3,441,056*	*1,126*	33				
1874	*3,477,704*	*1,246*	37				
1875	*3,514,744*	*76*	2				
1876	*3,552,183*	*39*	1				

135. It will be seen that the figures in the above table are not strictly comparable throughout, in that the deaths returned as from chicken-pox are included with those returned as from small-pox in each of the years 1855–1876, while excluded as regards the later years 1877–1894. The inclusion of deaths returned as from chicken-pox during the years 1855–1876 makes, however, no material difference; the number of deaths at all ages so returned being but small, in comparison with the deaths at all ages returned as from small-pox, except as regards the years 1868 and 1876, when the mortality from that disease was very small.

136. During the years 1855–63 the practice of vaccination was not obligatory in Scotland. Since 1848, however, under rules issued in that year by the Board of Supervision for the Relief of the Poor, the means of gratuitous vaccination had been provided in such parishes as from time to time participated in the Parliamentary grant in aid of medical relief.

> In 1863, as has been stated, the practice of vaccination was made compulsory in regard to children born in Scotland after the 1st January 1864. The provisions of this Act, and certain of the provisions of two later statutes having some bearing on the practice of vaccination in Scotland, are stated in §§ 123–125.

137. The records kept under the Vaccination Act, and tabulated by the Registrar-General of Births and Deaths in Scotland, show the amount of primary vaccination, performed within a certain period of birth, of children whose births were registered in Scotland during the years 1864–1893. The following table gives the figures ; for convenience of comparison we state them as nearly as we can in the same form as the

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* *Note.—The death-rates given in the table in § 134 are not solely based on the numbers, also given in that table, of the population and of the deaths ; but allowance is made for cases in which the cause of death was not specified.*

somewhat similar figures, given in §131, relating to the primary vaccination of children in England and Wales.

6, App. 634, Q. 27,883; 27,914.

Scotland

Year.	Births registered during Year.	Of the Children whose Births were registered during the Year given in the First Column, by the 31st December in the Year following that Year there were: Successfully vaccinated (including those found insusceptible of Vaccination from having been previously vaccinated).	Certified as insusceptible of Vaccination.	Had Small-pox.	Died unvaccinated.	Vaccination postponed by Medical Certificate.	Remaining.	The Children not finally accounted for (including cases postponed) being Per Cent. of Births.
1864 - - - -	108,851	95,487	667	154	9,180	662	2,701	3·1
1865 - - - -	113,129	99,855	474	34	9,366	719	2,681	3·0
1866 - - - -	113,730	100,635	332	30	9,433	579	2,721	2·9
1867 - - - -	114,181	101,290	233	16	9,355	670	2,617	2·9
1868 - - - -	115,514	102,370	277	7	9,440	914	2,506	3·0
1869 - - - -	113,441	99,439	177	17	10,069	966	2,773	3·3
1870 - - - -	115,446	102,104	215	28	9,724	843	2,532	2·9
1871 - - - -	116,184	102,098	241	142	10,280	841	2,582	2·9
1872 - - - -	118,959	105,224	184	64	10,325	811	2,351	2·7
1873 - - - -	119,810	105,340	162	39	10,527	1,113	2,629	3·1
1874 - - - -	123,861	108,227	206	33	11,288	1,229	2,878	3·3
1875 - - - -	123,651	108,348	190	1	11,326	1,211	2,575	3·1
1876 - - - -	126,706	112,163	177	5	10,760	1,034	2,567	2·8
1877 - - - -	126,900	112,709	180	4	10,374	1,304	2,329	2·9
1878 - - - -	126,854	112,100	190	3	10,905	1,196	2,460	2·9
1879 - - - -	125,782	111,818	180	3	9,999	1,290	2,492	3·0
1880 - - - -	124,674	109,740	155	0	11,016	1,404	2,359	3·0
1881 - - - -	126,277	111,360	150	0	10,587	1,586	2,594	3·3
1882 - - - -	126,162	110,543	192	4	11,073	1,713	2,637	3·4
1883 - - - -	124,516	109,271	194	2	10,713	1,884	2,452	3·5
1884 - - - -	129,123	112,387	242	0	11,694	1,964	2,836	3·7
1885 - - - -	126,152	110,094	225	0	10,872	2,073	2,888	3·9
1886 - - - -	127,968	111,105	201	0	11,282	2,325	3,055	4·2
1887 - - - -	124,467	107,450	236	0	11,269	2,465	3,047	4·4
1888 - - - -	123,294	107,131	216	0	10,434	2,417	3,096	4·5
1889 - - - -	122,849	105,217	235	0	11,479	2,692	3,226	4·8
1890 - - - -	121,612	103,883	222	2	11,779	2,710	3,016	4·7
1891 - - - -	126,076	107,762	268	1	12,293	2,637	3,115	4·6
1892 - - - -	125,119	107,568	345	0	11,693	2,468	3,045	4·4
1893 - - - -	127,155	108,390	509	1	12,781	2,474	3,000	4·3

From these figures it may be inferred that, as regards those children whose births were registered during each of the years 1864–1893, the proportion primarily vaccinated remained practically the same.

138. We are unable to make any numerical statement of the proportion, at one time as compared with another, during the period 1855–1894, of the population of Scotland who had at some time in their lives been vaccinated. We are able to state, however, that the proportion of the population who had at some time been vaccinated was not, during the years from 1855 to 1863, a high one. This is clearly indicated by the vaccination returns, from parishes participating in the Parliamentary grant, given by the Board of Supervision in their eighteenth annual report (at pages 219–20), by that Board's comment on those returns (at page x), and by the evidence given by Dr. Wood before the Select Committee of the House of Commons in 1871 (Questions 4355, 4371, 4474). During the years from 1864 onwards, down to the present time, that proportion has without doubt steadily grown, probably with a very even rate of increase. At no time during that period has there been any considerable opposition in Scotland to the practice of vaccination.

139. During the period 1855–1864 the death-rate from small-pox in Scotland, though varying from year to year, gave no indication of decline. Speaking generally of the period since 1864, there has been, as the table given in § 134 clearly shows, a marked though irregular decline in the death-rate from small-pox.

With this decline there has been in Scotland, as in England and Wales, a striking change in the age incidence of fatal small-pox.

In Ireland.

140. Exact statistics of the mortality from small-pox in Ireland are only available from the year 1864 onwards. On the taking, however, of the census in 1841, in 1851 and in 1861 (and again in 1871), inquiries were made as to the number and causes of death amongst the population, since the date of the previous census. From the information so obtained it has been calculated that the average annual death-rate from small-pox in Ireland per 100,000 living was 73 during the inter-censal period 1831–41, 49 during the inter-censal period 1841–51, and 21 during the inter-censal period 1851–61. It has not been suggested that these calculations, from materials depending on the recollection of the people who answered the census questions and based on the assumption that every death from small-pox was returned and returned but once, give any but approximate figures; there is reason to believe that the mortality from small-pox was probably even higher during the periods in question than the figures so obtained would indicate. Q. 2712. 2, App. 256. Q. 2716; 2742–55; 2764–5.

The following table shows the mortality from small-pox in Ireland during each of the years 1864–1894:—

Ireland

App. 256.

Year.	*Population.*	*Number of deaths returned from Small-pox only.*	Deaths returned from Small-pox *only* to every 100,000 living.
1864	*5,640,527*	*842*	15
1865	*5,594,589*	*457*	8
1866	*5,522,942*	*191*	3
1867	*5,486,509*	*16*	·3
1868	*5,465,914*	*21*	·4
1869	*5,449,094*	*14*	·3
1870	*5,418,512*	*30*	·6
1871	*5,398,179*	*660*	12
1872	*5,372,890*	*3,243*	60
1873	*5,327,938*	*496*	9
1874	*5,298,979*	*566*	11
1875	*5,278,629*	*531*	10
1876	*5,277,544*	*19*	·4
1877	*5,286,380*	*65*	1
1878	*5,282,246*	*864*	16
1879	*5,265,625*	*662*	13
1880	*5,202,648*	*381*	7
1881	*5,145,770*	*72*	1
1882	*5,101,018*	*129*	3
1883	*5,023,811*	*16*	·3
1884	*4,974,561*	*1*	·02
1885	*4,938,588*	*4*	·1
1886	*4,905,895*	*2*	·04
1887	*4,857,119*	*14*	·3
1888	*4,801,312*	*3*	·1
1889	*4,757,385*	*0*	0
1890	*4,717,959*	*0*	0
1891	*4,681,248*	*7*	·1
1892	*4,638,169*	*0*	0
1893	*4,615,312*	*1*	·02
1894	*4,600,599*	*72*	2

141. There are no available figures, comparable throughout the period 1831–1894, by which we can measure the extent to which, at one and another time, the practice of vaccination was accepted in Ireland in those years. There is no doubt that there has been, speaking generally, during that period a large spread of the practice. In §§ 115–121 we have given an account of the legislation from time to time enacted to this end, and we shall therefore merely recapitulate here the dates of the principal Acts of Parliament relating to the practice of vaccination in Ireland which have come into force during this period.

> In 1840–1 provision was made for vaccination in Ireland, as in England and Wales, at the expense of the Poor Rates. The arrangements made in consequence, appear, however, to have been by no means so complete in Ireland as they were in England and Wales; and, in October 1846, in 57 out of the 130 Unions into which Ireland was then divided, no arrangements had been made. Q. 3045.

> In 1851 it was provided that the medical officer of every dispensary district then constituted in Ireland should vaccinate all persons who might come to him for that purpose.

In 1858 it was provided that the committee of management of every dispensary district in Ireland should divide the district into so many vaccination districts as they might deem advisable and necessary, and should require the medical officer of the district to attend at some convenient place within each vaccination district for the purpose of vaccinating all persons resident in his district who might come to him.

In 1863 the practice of vaccination was made compulsory, within six months after birth, in regard to children born in Ireland after the 1st January 1864, and penalties were imposed for non-compliance.

In 1878 provisions, similar to those contained in section 31 of the English Vaccination Act of 1867, were enacted; the maximum penalty for non-compliance with the Justice's order directing vaccination, being, as in the English Act, twenty shillings, whereas the maximum penalty under the Irish Vaccination Act of 1863 for non-compliance with the requirement of vaccination was ten shillings.

In 1879 the Acts relating to vaccination in Ireland were amended; the practice of vaccination being made compulsory, within three months after birth, or within three months after being brought into Ireland, in regard to children born in, or brought into, Ireland after the passing of the Act. The maximum penalty under the Vaccination (Ireland) Acts for non-compliance with the requirement of vaccination was fixed at twenty shillings; the arrangements for the registration of vaccination were improved; and the Acts were amended in other ways. This amendment of the law was such as to render it less likely that the obligation to be vaccinated would be evaded. Q. 3045–7; 2738–9.

142. We are unable to make any numerical statement of the proportion, at one time as compared with another during the period 1831–1894, of the population of Ireland who had at some time in their lives been vaccinated. At no time during that period has there been any considerable opposition in Ireland to the practice of vaccination: and so far as we can judge of the effect of the efforts made during that period to extend the practice, the proportion of the population who had at some time been vaccinated has steadily grown, though with no even rate of increase, during the years from 1840 onwards down to the present time. The rate of increase, though varying considerably in different years, has no doubt on the whole been far greater since 1863 than in previous years. Q. 2900–3; 3050; 6299–311.

143. The approximate figures given in § 140 in regard to the death-rate from small-pox in Ireland during the inter-censal periods 1831–1841, 1841–1851, and 1851–1861, so far as they go, tend to show that the death-rate from small-pox was on the whole considerably less in the second period than in the first, and again considerably less in the third period than in the second; and that the death-rate from small-pox even in the third period was on the whole considerably greater than it has been in any ten years since 1863. Speaking generally then of the period since 1831, we find that there has been a marked though irregular decline in the death-rate from small-pox.

With this decline there has been in Ireland, as in England and Wales and Scotland, a striking change in the age incidence of fatal small-pox.

In England and Wales, Scotland and Ireland.

144. We have dealt so far with the evidence afforded by the statistics of the mortality from small-pox at different epochs in view of the spread or continued practice of vaccination. It seems to us scarcely possible to deny that speaking generally of the British Isles a more vaccinated population has exhibited a diminished mortality from small-pox. It was not, of course, to be expected that this should be seen year by year, or that the correspondence should be exact, even assuming vaccination to be the principal cause of this diminished mortality. We have already pointed out that small-pox tends at times to become epidemic, *i.e.*, to spread more readily than at other times. The occurrence of the conditions, whatever they may be, which cause the disease to be thus epidemic have of course no relation to the state of the population as regards vaccination, even conceding to the full that it has a protective effect. The only result of widespread vaccination, in a case where small-pox became epidemic, could be to

render the extent of the epidemic more limited, and its fatality less than it would otherwise be. All that we should anticipate then would be a general correspondence over a long series of years between a vaccinated condition of the people and a diminished mortality from small-pox.

145. In considering whether vaccination has been the principal cause of the decline, we must inquire whether the other causes suggested by those who deny the efficacy of vaccination will satisfactorily account for it.

146. It is said that the decline has, in the main, been due to changes in the general conditions of life in the different parts of the United Kingdom, apart from the spread of the practice of vaccination; amongst other things, to improvement of sanitary conditions.

147. It is beyond doubt that an infectious disease like small-pox is, other things being equal, more likely to spread in towns than in country districts, and more likely to spread in crowded town districts than in others not so densely populated; so that we should expect a lessened proportion of over-crowded dwellings, by diminishing the opportunities for contagion, to check the prevalence of the disease and consequently to render its mortality less.

148. Now it may be that during the period of the decline under consideration (that is in England and Wales during the period from 1838 onward, in Scotland from 1865 onward and in Ireland from 1841), a diminishing proportion of the population has, in the towns, been living in densely built areas and in over-crowded dwellings. So far as this has been the case, it has tended to the diminution of the prevalence of, and mortality from, small-pox.

149. On the other hand it is certain that, during the period of the decline, there has been in England and Wales and in Scotland, though not in Ireland, a large increase of the population; so that the density of the population in two out of these parts of the United Kingdom, taking each of them as a whole, has been increasing.

And it is equally certain, and probably far more important, that in all of them, during the period of the decline, there has been a continually growing proportion of the population living in the towns, and particularly in the larger towns. [Census reports: of England and Wales, in 1881, vol. iv., pp. 8–10; in 1891, vol. iv., pp. 9–12: of Scotland, in 1871, vol. i., pp. xvi and xxiii–xxv; in 1881, vol. i., pp. xiv and xviii; in 1891, vol. i., pp. xiii and xviii: of Ireland, in 1841, pp. vii–viii; in 1851, part vi., pp. xiii–xv; in 1861, part v., pp. ix–x; in 1871, part iii., pp. 12–13; in 1881, part ii., p. 6; in 1891, part ii., pp. 8–9.] This growth of the proportion of the population living in towns has been a condition tending to an increased prevalence of, and mortality from, small-pox.

150. There has also been, during the period of the decline, another change in the conditions of life, affecting all three countries, which would seem, at all events on *a priori* grounds, to have largely tended to an increased prevalence of small-pox; namely, the enormous and continued extension of movement among the population and of communication with other countries, following the increasing facilities for such movement and communication.

151. We have already pointed out that on *a priori* grounds it is reasonable to think that improved sanitary conditions would tend to diminish the fatality of, and so to a corresponding extent the mortality from, small-pox. And there can be no doubt that the period with which we are dealing has been characterised by an improvement of

this description. There has been better drainage, a supply of purer water, and in other respects more wholesome conditions have prevailed.

152. It may be useful at this point to furnish a brief summary of the principal Sanitary Acts which have been passed relating to the different parts of the United Kingdom.

In 1848 was passed the first great and comprehensive measure which may be called the groundwork of our sanitary legislation as regards England. The Public Health Act of 1848 was, however, principally designed for towns and populous places in England and Wales, not including the Metropolis, which was dealt with in Acts passed in the same year. The powers of local government supplied by the Act were generally an extension of those before given by sundry local Acts to Commissioners of Sewers in the metropolis, and to authorities in a few large towns. Many provisions corresponding to sections in the Towns Improvement Clauses Act of 1847 are found in the Public Health Act, and communities were thus enabled to obtain by a simple process powers which they could not previously obtain except by a local Act incorporating sections of the Towns Improvement Clauses Act.

In 1848 was also passed the Nuisances Removal and Diseases Prevention Act of that year, in substitution for a similar Act of 1846 which was about to expire; and in 1849 this Act of 1848 was amended. The provisions of all these three Acts extended to England, Scotland, and Ireland. In 1855 a comprehensive Nuisance Removal Act was, as regards England, substituted for the Acts passed in 1848 and 1849; and in the following year there was similar legislation for Scotland. In 1860 the English Act was amended, and in 1866, by the Sanitary Act of that year (to which we shall again refer) the provisions of the English Acts of 1855 and 1860, as then amended, were applied to Ireland.

In 1855 by the Metropolitan Local Management Act of that year, provision was made for the appointment of a medical officer of health and an inspector of nuisances by every vestry and district board in the metropolis. This provision did not extend to the City of London, where, in 1848, a medical officer of health had been appointed under power given by a local Act.

In 1858, the Local Government Act of that year, to be construed with the Public Health Act of 1848 as one Act, was passed, and took effect in all places where that Act was in force at the time of its passing; and, as regards England, these two Acts together constituted until 1872 the principal sanitary legislation on the statute book.

There followed, however, within the next ten years many public Acts having sanitary objects, some applying to all, and some to particular, parts of the United Kingdom, besides numerous other Acts of local application. We need only now specially refer to one of these public statutes, the Sanitary Act of 1866, which was probably the most important and applied, in part at least, to England, Scotland and Ireland. This Act, amongst other things, extended the powers of local authorities for the disposal of sewage and, in amending the English Nuisances Removal Acts of 1855 and 1860, added to the definitions of nuisances, especially as regards crowded houses and workshops, and to the duties and powers of local authorities for their abatement, especially in the way of providing means for disinfection and places for the reception of dead bodies.

In 1867 the Public Health (Scotland) Act was passed, a comprehensive measure which consolidated into one Act, with certain amendments, the whole statute law relating to the public health in Scotland.

In 1872 a complete distribution of England into sanitary districts took place, and some further amendments were made in the sanitary laws. In 1875 these laws were consolidated in the Act of that year. In 1891 a Sanitary Act was passed relating to the metropolis.

In 1874 an Act was passed for Ireland containing substantially the same provisions as those which had been enacted in the case of England in 1872.

153. We have seen, then, that if some changes have occurred tending to diminish mortality from small-pox, other changes have been simultaneously in progress tending in the contrary direction. We do not think it possible to strike the balance between

the two, and assert that it would tell in favour of a smaller mortality. In saying this we do not mean to indicate an opinion that sanitary improvements have been without an effect on small-pox mortality, but only that when all the changes which have occurred are considered it cannot be asserted that they afford an adequate explanation of the diminished mortality from small-pox.

154. If, however, improved sanitary conditions were the cause of the mortality from small-pox becoming less, we should expect to see that they had exercised a similar influence over almost all other diseases. Why should they not produce the same effect in the case of measles, scarlet fever, whooping-cough, and indeed any disease spread by contagion or infection and from which recovery was possible? Why should they not lead to these diseases also prevailing less, and to those attacked by them being better able to combat the disease?

155. We have had put before us no satisfactory answer to these questions. It has indeed been urged that whilst the diseases we have just mentioned almost exclusively affect children, small-pox largely attacks adults. We cannot feel that this circumstance is of much weight. It must be remembered that in former days small-pox was more fatal to children than to any other class. But apart from this we fail to see why improved sanitary conditions should enable children (and as we have said it is amongst them that the diminution of small-pox mortality has been greatest) to escape attacks of small-pox and overcome the disease rather than to escape from and overcome any of the other diseases to which we have referred.

156. In the case of measles there has not been during the period in question any diminution in the mortality corresponding with that displayed in the case of small-pox. The following table shows the mortality from measles in England and Wales during each of the years 1838–1842 and 1847–1894. The figures for the years 1843–1846 are not available.

X

6, App. 645.

Year.	Deaths from Measles to every 100,000 living.	Year.	Deaths from Measles to every 100,000 living.
1838 - -	43	1867 - -	30
1839 - -	71	1868 - -	53
1840 - -	59	1869 - -	46
1841 - -	43	1870 - -	34
1842 - -	54	1871 - -	41
1843 - -	Causes of death not abstracted by Registrar-General.	1872 - -	37
1844 - -		1873 - -	32
1845 - -		1874 - -	52
1846 - -		1875 - -	26
1847 - -	51	1876 - -	41
1848 - -	40	1877 - -	37
1849 - -	31	1878 - -	31
1850 - -	40	1879 - -	36
1851 - -	52	1880 - -	48
1852 - -	32	1881 - -	28
1853 - -	27	1882 - -	48
1854 - -	50	1883 - -	35
1855 - -	39	1884 - -	42
1856 - -	37	1885 - -	53
1857 - -	31	1886 - -	43
1858 - -	48	1887 - -	59
1859 - -	49	1888 - -	35
1860 - -	48	1889 - -	52
1861 - -	45	1890 - -	44
1862 - -	48	1891 - -	44
1863 - -	55	1892 - -	46
1864 - -	40	1893 - -	37
1865 - -	41	1894 - -	39
1866 - -	51		

See also Rep. 6. pp 645 Table A

157. The following table shows the mortality from measles in Scotland during each of the years 1855–94:—

Scotland

6, App. facing p. 641.

Year.	Deaths from Measles to every 100,000 living.	Year.	Deaths from Measles to every 100,000 living.
1855 - -	43	1877 - -	29
1856 - -	37	1878 - -	39
1857 - -	36	1879 - -	21
1858 - -	54	1880 - -	39
1859 - -	33		
1860 - -	54	1881 - -	27
		1882 - -	34
1861 - -	33	1883 - -	43
1862 - -	47	1884 - -	38
1863 - -	74	1885 - -	37
1864 - -	37	1886 - -	17
1865 - -	39	1887 - -	40
1866 - -	34	1888 - -	35
1867 - -	44	1889 - -	49
1868 - -	37	1890 - -	63
1869 - -	52		
1870 - -	26	1891 - -	44
		1892 - -	56
1871 - -	63	1893 - -	90
1872 - -	28	1894 - -	19
1873 - -	43		
1874 - -	32		
1875 - -	30		
1876 - -	36		

158. From the report on the census of Ireland in 1861 (Part III., vol. 2, page 20), we are able to obtain the number of deaths from measles ascertained by the census inquiries to have occured in Ireland during each of the inter-censal periods 1831–41, 1841–51 and 1851–61. Calculating from these figures the average annual death-rate during each of these periods from measles, in the same way as the average annual death-rates for the same periods from small-pox (given in §140) were calculated, we find that the approximate average annual death-rate from measles in Ireland per 100,000 living was 38 during the inter-censal period 1831–41, 38 again during the inter-censal period 1841–51, and 22 during the inter-censal period 1851–61.

The materials for the following table, showing the mortality from measles in Ireland during each of the years 1864–94, have been obtained from the annual reports of the Registrar-General of Births and Deaths in Ireland.

[illegible]

Year.	Deaths from Measles to every 100,000 living.	Year.	Deaths from Measles to every 100,000 living.
1864 - -	11	1880 - -	20
1865 - -	19		
1866 - -	15	1881 - -	8
1867 - -	24	1882 - -	30
1868 - -	23	1883 - -	16
1869 - -	17	1884 - -	11
1870 - -	18	1885 - -	27
		1886 - -	6
1871 - -	10	1887 - -	27
1872 - -	26	1888 - -	40
1873 - -	24	1889 - -	12
1874 - -	13	1890 - -	15
1875 - -	17		
1876 - -	12	1891 - -	5
1877 - -	29	1892 - -	26
1878 - -	41	1893 - -	23
1879 - -	16	1894 - -	26

159. It will be seen that the death-rate from measles in all three countries has, as might be expected, varied considerably from year to year. Neither in England and Wales, nor in Scotland or Ireland, has that death-rate, however, shown any indication of a decline at all comparable with the decline in the death-rate from small-pox which has distinguished the period now under consideration, viz., in England and Wales the period from 1838 onward, in Scotland from 1865 onward, and in Ireland from 1841.

We find, indeed, as regards England and Wales, that though the death-rate from measles was higher in the three years 1838, 1839 and 1840 than it has been in any three consecutive years since, there has been no material decline in that death-rate during the years 1838–94. As regards Scotland, we find that there has been no material decline in the death-rate from measles during the years 1855–94. As regards Ireland we find that the death-rate from measles was on the whole considerably less during the inter-censal period 1851–60 than during the earlier inter-censal periods 1831–40 and 1841–50, but that there has since been no material decline in that death-rate.

160. The total effect, then, of the changes in sanitary conditions to which we have referred on the mortality from measles would seem, in England and Wales and in Scotland, to have been scarcely appreciable; and in Ireland to have been limited to a decline in the death-rate, trifling in amount in comparison with the decline in the death-rate from small-pox, and manifested, moreover, during a part only of the period of that decline.

161. The following table shows the mortality from scarlet fever and from diphtheria in England and Wales during each of the years 1838–1842 and 1847–1894. We are unable, for the earlier years included in the table, to separate those causes of death.

6, App. 645.

Year.	Deaths from Scarlet Fever to every 100,000 living.	Deaths from Diphtheria to every 100,000 living.	Year.	Deaths from Scarlet Fever to every 100,000 living.	Deaths from Diphtheria to every 100,000 living.
1838 - -	38		1867 - -	57	12
1839 - -	67		1868 - -	100	14
1840 - -	126		1869 - -	124	12
			1870 - -	145	12
1841 - -	89				
1842 - -	79		1871 - -	82	11
1843 - -	Causes of death not abstracted by Registrar-General.		1872 - -	52	9
1844 - -			1873 - -	56	11
1845 - -			1874 - -	105	15
1846 - -			1875 - -	85	14
1847 - -	86		1876 - -	69	13
1848 - -	118		1877 - -	59	11
1849 - -	75		1878 - -	75	14
1850 - -	75		1879 - -	69	12
			1880 - -	68	11
1851 - -	76				
1852 - -	104		1881 - -	55	12
1853 - -	85		1882 - -	52	15
1854 - -	100		1883 - -	47	16
			1884 - -	40	19
1855 - -	89	2	1885 - -	23	16
1856 - -	71	3	1886 - -	22	15
1857 - -	65	8	1887 - -	28	16
1858 - -	121	34	1888 - -	23	17
1859 - -	98	52	1889 - -	24	19
1860 - -	49	26	1890 - -	24	18
1861 - -	45	23	1891 - -	17	17
1862 - -	73	24	1892 - -	19	22
1863 - -	148	32	1893 - -	24	32
1864 - -	142	26	1894 - -	17	29
1865 - -	84	20			
1866 - -	55	14			

162. The following table shows the mortality from scarlet fever in Scotland during each of the years 1855–94:—

6, App. facing p. 641.

Year.	Deaths from Scarlet Fever to every 100,000 living.	Year.	Deaths from Scarlet Fever to every 100,000 living.
1855 - -	79	1877 - -	39
1856 - -	108	1878 - -	53
1857 - -	79	1879 - -	44
1858 - -	94	1880 - -	59
1859 - -	126	1881 - -	42
1860 - -	101	1882 - -	42
1861 - -	60	1883 - -	35
1862 - -	43	1884 - -	33
1863 - -	115	1885 - -	24
1864 - -	111	1886 - -	27
1865 - -	75	1887 - -	30
1866 - -	89	1888 - -	18
1867 - -	104	1889 - -	18
1868 - -	143	1890 - -	19
1869 - -	136	1891 - -	18
1870 - -	4	1892 - -	22
1871 - -	79	1893 - -	20
1872 - -	64	1894 - -	20
1873 - -	66		
1874 - -	186		
1875 - -	137		
1876 - -	68		

163. As regards Ireland, obtaining from the report on the census in 1861 the number of deaths from scarlet fever ascertained by the census inquiries to have occurred during each of the inter-censal periods 1831–41, 1841–51, and 1851–61, and calculating, as before, from these figures the average annual death-rate during each period, we find that the approximate average annual death-rate from scarlet fever per 100,000 living was 10 during the inter-censal period 1831–41, 26 during the inter-censal period 1841–51, and 43 during the inter-censal period 1851–61.

The materials for the following table, showing the mortality from scarlet fever in Ireland during each of the years 1864–94, have been obtained from the annual reports of the Registrar-General of Births and Deaths in Ireland:—

Year.	Deaths from Scarlet Fever to every 100,000 living.	Year.	Deaths from Scarlet Fever to every 100,000 living.
1864 - -	46	1880 - -	47
1865 - -	66	1881 - -	26
1866 - -	63	1882 - -	24
1867 - -	39	1883 - -	35
1868 - -	49	1884 - -	28
1869 - -	66	1885 - -	23
1870 - -	55	1886 - -	17
1871 - -	41	1887 - -	20
1872 - -	46	1888 - -	18
1873 - -	39	1889 - -	10
1874 - -	76	1890 - -	7
1875 - -	73	1891 - -	7
1876 - -	42	1892 - -	9
1877 - -	21	1893 - -	10
1878 - -	20	1894 - -	13
1879 - -	32		

164. It will be seen that the death-rate from scarlet fever in all three countries has varied considerably from year to year. Neither in England and Wales, nor in Scotland or Ireland, has that death-rate, however, exhibited a decline comparable with the decline in the death-rate from small-pox which has distinguished the period now under

consideration, viz., in England and Wales the period from 1838 onward, in Scotland from 1865 onward, and in Ireland from 1841.

We find, indeed, that in England and Wales, in Scotland, and in Ireland, there was no sign of any decrease in the death-rate from scarlet fever until about 1880 or shortly before that year. During the last 10 to 12 years there has undoubtedly been in each part of the United Kingdom a marked decline in that death-rate. We think that the steps which have been taken in various ways to isolate persons suffering from scarlet fever have largely contributed to this decline.

165. We do not think it necessary to burden our report with similar details in reference to the mortality from whooping-cough during the period under discussion. It will be sufficient to say that there has been no decline in the mortality from that disease corresponding with the decline in small-pox mortality.

166. Great stress has been laid on the fact that the records of the Registrar-General show that the mortality returned under the head "fevers" has very largely diminished. But it is notorious that in comparatively recent years the nomenclature and classification of diseases where fever is present have undergone great changes, owing to improved diagnosis. In the case of many such diseases where the cause of death was formerly returned merely as "fever," it is now attributed to some other disease separately specified. The apparent diminution is therefore not entirely a real one. Changes in nomenclature and classification, however, cannot wholly explain the diminution in the number of deaths returned as due to fever, though they prevent exact quantitative comparison such as can be made in the case of diseases like small-pox, measles, &c. The mortality from fevers has undoubtedly decreased largely. In considering the relation of this decrease to improved sanitary conditions, it is important to advert to the nature of these sanitary improvements. They may be broadly classed as follows:—(*a*) Drainage, including in the term the removal of moisture from damp and swampy places, and the adequately rapid and effectual removal of the excreta of the bowels and the kidneys. (*b*) Ventilation of dwellings or the rapid and effective renewal of the air surrounding the inhabitants. (*c*) Lighting of dwellings. The means taken to secure this also entail greater ventilation; the two go together, but besides this the effect of light on organisms or microbes, to which contagia seem analogous, would lead one to suppose that increased light, at least sunlight, tended to destroy contagia. (*d*) A supply of pure water for drinking purposes. (*e*) Personal cleanliness. This, apart from its influence on general health, would have a tendency to render an individual less likely to receive contagion and less likely to convey it to another. (*f*) The increased general recognition, during the last 10 or 20 years especially, of contagion as the source of certain diseases, and increased knowledge of the means of avoiding its spread, may be recognised as a sanitary improvement of no slight value. It is obvious that these sanitary changes are not calculated to affect even all zymotic diseases in the same manner and to the same extent. The chief fevers are (1) malarial fevers, (2) typhus, (3) typhoid. There is much uncertainty concerning the fever classed as "simple continued," nor does this appear ever to have contributed largely to the returns. Now malarial fevers are directly dependent on the development of the contagia in swamps and marshes; when these are adequately drained the fevers disappear. Typhus fever, which seems to have furnished the largest share of "fevers" in the last and in the beginning of this century, is found to prevail in connexion with overcrowding in dark ill-ventilated dwellings, combined with deficient nutrition. When these conditions cease, the fever disappears, and typhus has thus become almost unknown in this country at the present day. Typhoid fever is directly dependent on the contagia furnished by the excreta of one case being introduced into the alimentary canal. Where, by means of adequate drainage and personal cleanliness, this is prevented, the disease is prevented also. In the case of each of these fevers, then, there are special circumstances developing the disease which sanitary improvements tend directly to remove. There is no like feature in the case of small-pox. It resembles measles in this, that the spread of it is not connected with any particular sanitary fault, as distinguished from those general conditions which tend to the spread of infectious disease. There is no evidence in the history of small-pox, either before or during the nineteenth century, to connect outbreaks of that disease in a special way either with imperfect removal of excreta, or with lack of air and light, or with deficient food, or with lack of personal cleanliness. Moreover, the general tendency of sanitation to lower the prevalence and the fatality of the disease is largely neutralised both in the case of small-pox and measles by the greater facility of intercourse. Whilst, then, there is

ample reason to regard the decrease in the case of typhus and typhoid fever (and it may perhaps be said of fever generally) as the result of improved sanitary conditions, since each of these is specially dependent on conditions which sanitary improvements have removed, there is no adequate reason to attribute the decrease of small-pox in the nineteenth century to a similar cause, though we fully recognise that sanitary improvements have had an effect in reducing the mortality from small-pox as from the other diseases to which we have just been referring. This view is strongly confirmed by the fact that in spite of sanitary improvements the mortality from measles and whooping-cough has remained undiminished, and the diminution in the mortality from scarlet-fever has only been apparent in comparatively recent years.

167. It has been maintained that the decline in small-pox mortality is largely due to more frequent and systematic attempts to isolate those suffering from small-pox. We think an answer to this contention is to be found in the fact that, as we shall presently show (§§ 460–479), it is only in quite recent years that there has been any systematic practice of isolating small-pox patients, and that it has been confined even then to a very limited number of localities. The fact to which we are about to call attention in greater detail than hitherto, that the decline in the deaths from small-pox is found almost exclusively among those of tender years, appears also to militate against the contention. The risk of contagion is not confined to children. Adults also are subject to it. If a better system of isolation had been a main cause of the reduced mortality, we should have expected to see it operate in the case of adults as well as of children. At the same time we are far from thinking, as will appear when we come to deal with that subject, that the efforts at isolation which have characterised recent years have been without a beneficial effect on small-pox mortality.

168. A study of the age incidence of small-pox mortality is very instructive. In connexion with this point it is necessary to bear in mind that experience has led to the conclusion that whatever be the protective effect of vaccination it is not absolutely permanent; the most convinced advocates of the practice admit that after the lapse of nine or ten years from the date of the operation, its protective effect against an attack of small-pox rapidly diminishes, and that it is only during this period that its power in that respect is very great, though it is maintained that, so far as regards its power to modify the character of the disease and render it less fatal, its effect remains in full force for a longer period and never altogether ceases. The experience upon which this view is founded is derived almost exclusively from the case of infantile vaccination. It has been supposed by some that the transitory character of the protection results from changes connected with the growth from infancy to adult years. Whether this be so or not, we have no means of determining.

169. No doubt when Jenner drew the attention of the public to the value of vaccination, he believed that a single successful inoculation of vaccine matter secured absolute immunity for the future from an attack of small-pox. It is certain that in this he was mistaken. It may well be doubted whether the anticipation was a reasonable one. No such immunity is secured by an attack of small-pox, though there are few who would maintain the proposition that it is without protective influence against another attack. *A priori* there would seem to be no sound ground for expecting that vaccinia would afford more potent protection than small-pox itself. The extent of the protection afforded (assuming that there is some protective influence) could only be determined by experience. It soon became apparent that Jenner had, in the first instance, over-rated the effect of vaccination. That he should thus have over-estimated it is not to be wondered at, when the tendency to be unduly sanguine, which besets the discoverer of any new prophylactic, and, indeed, every discoverer, is borne in mind.

The changed age-incidence of fatal small-pox.

170. The fact has been already noted that in the eighteenth century (and there is no satisfactory evidence that there was a difference in this respect in earlier centuries) small-pox was fatal chiefly to children; indeed, in particular local epidemics of which we have records, the mortality was confined entirely, or almost entirely, to that class of the population. Adults were at that time very largely protected by a previous attack of small-pox. Children were then the only class, for the most part, unprotected. During the present century this cause of protection has largely diminished; it is now only a very small section of the community which enjoys protection thus acquired. If, then, vaccination be most potent in its effect during the first few years after

the inoculation of the vaccine matter, we should expect to find the conditions which formerly existed reversed—children would be the best, adults the worst protected class.

171. Applying ourselves now to the statistics on this head, we find a remarkable change in the age incidence of small-pox mortality. The following table exhibits the change which has taken place in this respect. For the years 1848–54 cases of chicken-pox are unavoidably included, there being no means of distinguishing them. This, of course, tends to increase unduly the share of mortality borne by the earlier age periods, but the information which we possess with reference to chicken-pox mortality since mortality from that disease has been separately recorded, enables us to say that the error thus introduced cannot seriously affect the comparison. From 1855 onwards chicken-pox has been uniformly excluded, so that from that date there is nothing to affect it.

ENGLAND AND WALES : DEATHS from SMALL-POX at certain age periods to 1,000 deaths from small-pox at all ages.

——	Under 1.	1–5.	5–10.	10–15.	15–25.	25–45.	45 and upwards.
1848–54 - -	251	426	130	33	75	67	18
1855–59 - -	231	328	144	37	117	112	31
1860–64 - -	237	313	108	42	123	133	44
1865–69 - -	231	314	103	33	126	145	48
1870–74 - -	143	169	140	58	200	224	66
1875–79 - -	112	129	113	72	218	266	90
1880–84 - -	113	122	98	68	216	286	97
1885–89 - -	112	81	54	51	229	344	129
1890–94 - -	166	117	50	26	131	338	172
1895-99							
1900-04							

05-09
1910
1915

The first point calling for notice is that in the period 1855–59, as compared with the earlier period, there was a considerable diminution in the share of small-pox mortality borne by those between one and five years of age. In the earlier period it was 426, in the latter 328. As regards those under one year of age the share fell from 251 to 231. It must, of course, be remembered that whatever the prevalence of vaccination amongst children the age-period under one year will always contain a considerable unvaccinated class. We are naturally led to inquire whether there is anything in the history of vaccination to account for the remarkable change we have adverted to. In the year 1853 vaccination was made compulsory, and though no sufficient means were provided for rendering the law effectual it cannot be doubted that it was calculated to increase vaccination in the subsequent years.

The next marked change is seen in the quinquennium 1870–74. The proportion of small-pox mortality borne by those under 1 year of age decreased from 231 to 143, and of those between 1 and 5 years of age from 314 to 169. We have already called attention to the fact that in 1867 power was given to the Guardians to appoint Vaccination Officers, and that advantage was taken of this from time to time by different Unions, though a large number remained without such officers until after 1871 when their appointment was made compulsory. There can be no doubt that the effect of this legislation was to cause an increasing extension of the practice of vaccination in 1868 and subsequent years, and very largely to increase the amount of vaccination in and subsequently to the year 1871. The effect of this would be at once felt in the earliest age-periods, and at a period correspondingly later in the succeeding age-periods. We have already pointed out the marked change in the incidence below 5 years of age in the quinquennium 1870-74, and it will be seen that in subsequent quinquennia there was a diminished incidence in the age-periods 5–10 and 10–15 and later still in the period 15–25. During the last quinquennium there has been some increase in the incidence of the disease in the first two life-periods. This has been coincident with some diminution in the practice of vaccination.

172. The following table shows the death-rates in England and Wales from small-pox per million living during the seven years from 1848–54, and for each decennium

since that period. It is to be remembered that, as already stated, the deaths for the years from 1848–54 include those from chicken-pox as well as small-pox :—

——	Under 5.	5–10.	10–15.	15–25.	25–45.	45 and upwards.
1848–54 - -	1,514	323	91	110	69	24
1855–64 - -	788·8	209·5	68·7	118·9	87·8	36·2
1865–74 - -	782·5	333·2	142·3	267·2	220·7	87·5
1875–84 - -	127·8	62·9	46·4	82·4	76·6	33·9
1885–94 - -	50·2	14·9	11·1	24·0	31·6	19·0

It will be observed that in the decennium 1855–64 there was a very large diminution of the mortality at the age-period under 5 years, a considerable though smaller diminution at the next age-period, and some diminution at the age-period from 10–15. Supposing the compulsory law of 1853 to have augmented to some extent infantile vaccination, its effect would be felt in the class under 5 years of age during the greater part of the decennium. It would affect the class aged 5–10 years during a smaller part of the decennium, and the class aged 10–15 only during the last year or two. The next decennium, 1865–74, included the years of the great epidemic, to which allusion has already been made. Its effects are apparent on most of the mortality rates of those years. As compared with the preceding decennium there was a very great increase of mortality at all the later age-periods. It is noteworthy that as regards those under 5 years of age the mortality was actually less, though very slightly so, than in the preceding decennium. And though there was increased mortality in the next age-period, the increase was less than in the later age-periods. It is impossible not to be struck by this fact when it is remembered that in 1867 and again in 1871, laws were passed calculated to increase the amount of infantile vaccination. The more stringent enforcement of the practice under these laws would considerably affect the class under 5 years of age during the decennium 1865–74, and the effect of the Act of 1867 would be felt to some though only to a slight extent in the class aged 5–10. Again in the next decennium, 1875–84, the fall was very great in the mortality in the first two age-periods; it was reduced to 127·8 and 62·9 as compared with 1,514 and 323 in the years 1848–54, or with 788·8 and 209·5, making the comparison with the decennium, 1855–64, when chicken-pox was not included. The results of the legislation of 1867 and 1871 would affect the class under 5 during almost the whole of this decennium, and would largely affect those in the next age-period. It would influence sensibly the class between 10 and 15 years of age and slightly the next higher age-period. It would be without effect in the classes over 25 years of age. We find the mortality rate in these classes 76·6 and 33·9, being actually higher than in the years 1848–54, for which the figures are 69 and 24, and not much below the figures for the next decennium, viz., 87·8 and 36·2. Comparing on the other hand the rates at the age-periods 10–15 and 15–25, the figures are 46·4 and 82·4 as against 91 and 110 for the years 1848–54, and 68·7 and 118·9 for the next decennium. In the decennium 1885–94 there was much less small-pox than in either of the preceding terms of years with which we have been dealing. Isolation and measures of that description were, no doubt, having their effect. The decrease was, however, largest in the age-periods which would be most affected by the results of the legislation to which we have directed attention. Comparing the first and last terms of years, the reduction in the first three age-periods was from 1,514, 323, and 91 to 50·2, 14·9, and 11·1, in the age-period 15–25 from 110 to 24, and in the two highest age-periods from 69 and 24 to 31 and 19 only.

173. It is right to observe that there must have been among those whose age exceeded 10 a certain number who had been re-vaccinated. The effect of this operation would be to restore protection, if protection there be, and to place the re-vaccinated in a somewhat similar relation to those of the same age who had been once vaccinated as vaccinated children bear to unvaccinated. It is not possible to ascertain the number of re-vaccinated persons in the class over 10 years of age in the two epochs respectively. But it seems clear that the mass of the people were not at either epoch re-vaccinated, and we do not think that the number of the re-vaccinated was sufficiently large to affect materially the value of any inferences to be drawn from the contrast to which we have directed attention. We may observe, however, that in discussing the effect of vaccination the question of re-vaccination will have to be considered, and that any

phenomena exhibited by the class of re-vaccinated persons, when compared with those of a similar age who have been only vaccinated in infancy, have a similar relevancy to the contrast afforded in the case of vaccinated and unvaccinated persons of a similar age.

174. It is not necessary to give in detail the statistics showing the change of age incidence in small-pox mortality in Scotland and Ireland. They exhibit the same general features.

There are, however, some particulars relating to Scotland which seem sufficiently important to deserve special notice. The following table was furnished by the Registrar-General of Births and Deaths in Scotland:—

DEATHS at VARIOUS AGES in SCOTLAND from SMALL-POX during the periods 1855–63 and 1864–87, and the proportion of such deaths at each age to every 1,000 deaths at all ages from the same disease, with the mean annual death-rate from SMALL-POX during those periods per 1,000,000 living at each age.

6, App 636.

Period.	—	All Ages.	0–6 Mths.	6–12 Mths.	0–12 Mths.	1–5 Years.	5–10 Years.	10–15 Years.	15–25 Years.	25–45 Years.	45 Years and over.	Age not stated.
1855–63. (*The nine years prior to the Vaccination Act.*)	Actual deaths in period - -	8,807	1,227	1,345	2,572	3,639	795	222	627	688	256	8
	Proportion of deaths at each age to every 1,000 deaths at all ages - - - - - -	1,000	139	153	292	413	90	25	71	78	29	—
	Mean annual death-rate during period per 1,000,000 living at each age - - - - -	321	—	—	3,175	1,243	244	77	119	99	48	—
1864–87. *The twenty-four years subsequent to the Vaccination Act.*)	Actual deaths in period - -	9,240*	1,276	437	1,713†	1,265‡	881§	749	1,867	2,137	624	12
	Proportion of deaths at each age to every 1,000 deaths at all ages - - - - -	1,000	138	47	185	137	95	81	202	231	67	—
	Mean annual death-rate during period per 1,000,000 living at each age - - - - -	108	—	—	679	139	86	81	115	100	38	—

* This 9,240 includes 59 deaths from chicken-pox.
† „ 1,713 „ 38 „ „ (20 of them being included in the 1,276 deaths under six months, and 18 in the 437 deaths between six and twelve months.)
‡ This 1,265 includes 19 deaths from chicken-pox. § This 881 includes 2 deaths from chicken-pox.

It will be observed that the proportion of deaths borne by those under six months, who would be in both periods (substantially) an unvaccinated class, was almost exactly the same, whilst the proportion borne by those between six months and a year, and between one and five years of age, was greatly diminished. There was a slight increase in the proportion of those between five and ten years, but this was due to the very large decrease of the proportion borne by those of an earlier age and not to any increase of the mean mortality in the class aged 5–10 in the later period, for the mean annual death-rate per million living fell greatly, viz., from 244 to 86. Above the age of ten, the mean annual death-rate remained about the same. There was a small increase in the ages 10–15 and a small decrease in the ages 15–25.

Inquiries as to six recent local epidemics of small-pox.

175. Specially valuable information bearing on the protective influence of vaccination is, we think, to be found in the careful and scientific investigations which have been instituted in the case of several recent local epidemics. The first of these was the work of Dr. Barry during the Sheffield epidemic of 1887–8. This inquiry was made at the instance of the Local Government Board, Dr. Barry being one of the Board's medical inspectors. Five others have been conducted by medical men appointed by ourselves. Dr. Coupland reported on the epidemics in Dewsbury and Leicester, which took place in 1891–2 and 1892–3 respectively; Dr. Luff on outbreaks in London in 1892–3; Dr. Savill on an epidemic which visited Warrington in 1892–3; and Dr. Coupland on an epidemic in Gloucester in 1895–6.

The age-incidence of fatal small-pox in these epidemics.

176. We now proceed to consider the evidence derived from these reports so far as it bears on the age incidence of small-pox mortality. In the first place, we may notice the interesting comparison in this repect, to which Dr. Barry called attention, between the epidemic at Sheffield in 1887–8, which he investigated, and previous epidemics which had visited that town.

Q. 2047. 177. During the 1857–8 epidemic out of every 100 small-pox deaths among people of all classes the share borne by children under 10 years of age was 85, as against 15 borne by persons of 10 years and upwards. During the 1863–4 epidemic the share borne by the class under 10 years was 86, as against 14 borne by the class over 10 years of age. During the 1868–9 epidemic the share borne by the class under 10 years of age was 84, as against 16 borne by the class above that age. During the 1871–2 epidemic the share borne by the class under 10 years of age was 64, as against 36 borne by the class above that age. During the 1887–8 epidemic the share borne by the class under 10 years of age was 27, as against 73 borne by the class above that age.

178. The per-centage of the total deaths from small-pox of those dying between the ages 0–10 amongst the population enumerated in the census at Sheffield in 1887–8 was 25·6. This per-centage is calculated upon a total of 500 deaths, of which the deaths of those in that age period were 128. The particulars are contained in Tables XCVI. and XCIV., pp. 178 and 176 of Dr. Barry's report, which were compiled from the census taken in February 1888 and included all the deaths which had occurred up to the end of the enumeration. Inasmuch, however, as Dr. Barry excluded from Table XCVI.* all deaths of children under one month, these have been added so that for the purposes of comparison the basis of the statistics relating to Sheffield and the other towns should be the same.

App. III., p. 29. 179. In Dewsbury in 1891–2 the deaths between the ages of 0–10 were 57 out of a total of 110, or 51·8 per cent. of the total deaths.

App. IV., pp. 2 and 12. 180. In London in 1892–3 the deaths between the ages of 0–10 were 67 out of 182, or 36·8 per cent. of the total deaths.

App. V., p. 35. 181. In Warrington in 1892–3 the deaths between the ages of 0–10 were 14 out of 62, or 22·5 per cent. of the total deaths.

App. VI., p. 43.; and pp. 26 and 27. 182. In Leicester in 1892–3 the deaths between the ages of 0–10 were 15 out of 21, or 71·4 per cent. of the total deaths. In consequence of the proximity of a scarlet fever ward to the hospital in which small-pox cases were treated, several children in that ward were attacked by small-pox, of whom three died. It may be suggested that this circumstance would be likely to render the infant mortality exceptionally high at Leicester as compared with the other towns. If, however, these three deaths be excluded altogether from the calculation, it only reduces the per-centage from 71·4 to 66·6.

App. VII. 183. In Gloucester in 1895–6 the deaths between the ages of 0–10 were 280 out of 434, or 64·5 per cent. of the total deaths.

184. It will be convenient for purposes of comparison to place them together in the following table :—

—	Per-centage of the Total Small-pox Deaths borne by those between the Age of 0–10.
Warrington - - - - -	14 out of 62 22·5
Sheffield - - - - -	128 out of 500 25·6
London - - - - -	67 out of 182 36·8
Dewsbury - - - - -	55 out of 110 51·8
Gloucester - - - - -	280 out of 434 64·5
Leicester - - - - -	15 out of 21 71·4 [or 66·6. *See* § 182.]

185. It will be seen that whilst at Leicester and Gloucester the deaths under 10 years of age were considerably more than half the total deaths, the deaths of children of a similar age at Dewsbury slightly exceeded one half. In London the deaths under 10 were considerably less than half. At Sheffield and Warrington they were about a quarter

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* *Note.—We have in this* (§178) *and the following paragraphs referred to the particulars contained in this table* (*Table XCVI.*) *rather than to those found in the table based upon the records in the Health Office* (*which is Table CI. on page* 191 *of the report*), *because as regards most of the matters with which we are concerned, at all events, it seems more to be relied on. If the figures relating to age incidence be taken from the latter table the per-centage of deaths at the ages* 0–10 *works out at* 26·9.

of the total deaths. The variations are very striking, ranging from 22·5 at Warrington to 71·4 at Leicester, and the approximation between the per-centages at Sheffield and Warrington, as compared with those of the other towns, is also worthy of note. One is naturally led to inquire what is the explanation of these remarkable differences in the age incidence of the fatal cases of small-pox?

186. According to Dr. Savill, the requirements of the law with reference to vaccination had been very well complied with in Warrington, and the per-centage of the population unvaccinated was very small. Dr. Barry's report with regard to the vaccination of Sheffield is to the same effect.

187. Turning to the returns of vaccination in Sheffield for the years 1878–87, we find that the children not finally accounted for (including cases postponed) amounted during that period to 4·5 of the births.

The return for the Union of Warrington (which includes the borough) shows for the 10 years 1883–1892 that the children not accounted for (including, as before, postponed cases) was 4·8 per cent. of the births.

There was probaby not much difference between the condition of Sheffield and Warrington as regards vaccination, though it is of course not possible to ascertain with perfect accuracy their relative position in this respect.

188. In London there had been a considerable falling off in the amount of vaccination for some years prior to 1892. In 1883 the per-centage of births left unaccounted for (including, as before, the postponed cases) was 6·5. It was not materially different in the following year. In 1885 it had increased to 7 per cent.; in 1886 to 7·8; in 1887 to 9 per cent.; in 1888 to 10·3 per cent.; in 1889 to 11·6 per cent.; in 1890 to 13·9 per cent, and in 1891 to 16·4 per cent. Taking these years together, the per-centage left unaccounted for is 9·9. The per-centages we have given are derived of course from a very large number of births, so that the increase in the number appearing thus to be left unvaccinated is very considerable. Thus in the year 1883 the number unaccounted for was 7,816, whilst in 1891 it was 19,806. There seems to be no doubt, therefore, that, so far as regards the class under 10 years old, London compared unfavourably as regards the amount of vaccination both with Warrington and Sheffield.

189. In Dewsbury vaccination had been greatly neglected. In the year 1882 the per-centage of children born and unaccounted for was 12·6. In 1883, 20·0; 1884, 37·6; 1885, 47·2; 1886, 37·5; 1887, 29·6; 1888, 32·2; 1889, 37·3; 1890, 39·1; 1891, 32·5; 1892, 37·7. Taking these years together, the per-centage is 32·3. It will thus be seen that the child population of Dewsbury was in a condition less vaccinated than that of London.

190. In Leicester, the practice of vaccination had been very largely abandoned for some years prior to the epidemic.

In the years preceding the epidemic the per-centages of births left unaccounted for were as follows:—

1883	43·8	1888	77·0
1884	47·9	1889	79·8
1885	52·1	1890	78·7
1886	69·1	1891	79·9
1887	72·2	1892	80·1

191. In Gloucester, as in Leicester, the practice of vaccination fell into disuse for some years prior to the epidemic, in the ten years preceding which the per-centages of births left unaccounted for were as follows:—

1885	10·6	1890	83·2
1886	18·1	1891	84·7
1887	58·8	1892	86·9
1888	79·3	1893	86·0
1889	83·2	1894	85·1

192. We thus find that with a well-vaccinated child population, such as that of Warrington or Sheffield, the proportion of the total deaths borne by that class was very small.

In Leicester and Gloucester, where the child population was very ill vaccinated, the proportion of deaths borne by that class was very large; whilst in London and Dewsbury the proportion of the total mortality borne by children lay between the rates at Warrington and Sheffield on the one hand and Gloucester and Leicester on the other, being considerably higher in Dewsbury (which as regards vaccination was in closer approximation to the condition of Gloucester and Leicester) than in London. If the proposition that vaccination has a very potent protective influence for 9 or 10 years be a sound one, the difference in the degree of vaccination of the child population in the several towns at the time when they were visited by the epidemics would account for the particular phenomena we have been examining.

193. We cannot but lay stress upon the facts thus revealed by the investigation of recent epidemics in these six towns. These facts are not open to the same chance of error as is involved in a comparison of the mortality among persons said to be vaccinated or unvaccinated. The age at which deaths occur may be said to be practically a matter of certainty, whilst the proportion of deaths below a given age to deaths above that age is free from liability to error. And even if the proportion of vaccinated to unvaccinated children under 10 be not capable of precisely accurate ascertainment, there can be no doubt that the proportion was very great in Warrington and Sheffield and very small in Gloucester and Leicester, whilst in London and Dewsbury it lay somewhere between the two; and the proportion of the unvaccinated in Dewsbury may with confidence be asserted to have been greater than in London.

194. We have said that the phenomena are accounted for on the supposition that vaccination has the protective influence alleged. Is there any other satisfactory explanation of them? It is argued that improved sanitary conditions would tend to diminish the mortality amongst children, but if this were the explanation similar changes of age incidence ought to be seen in the mortality from all other diseases. This, however, is not the case.

195. Reverting to the statistics for England and Wales, it appears from the figures given in the reports of the Registrar-General that the proportion of the total mortality from measles, whooping-cough, and scarlet fever respectively borne by children has remained almost uniform, the variations have been very trifling. In the case of Scotland
6, App. 636– also, whilst the same change in the age incidence of small-pox mortality is to be
7. observed, there, as in England and Wales, no similar change of age incidence is to be found in the mortality from measles, scarlet fever, or whooping-cough.

196. In Sheffield the age incidence has scarcely varied in the case of measles and
Q. 1957–9. scarlet fever, and only slightly so in the case of whooping-cough during the last 30 years, and there is no reason to think that the circumstances are materially different in this respect in any of the other towns with the epidemics in which we have been dealing.

197. It has been suggested that small-pox is specially amenable to improved sanitary conditions, and that this appears from the influence which they have in diminishing the proportion in which those under five years of age die of small-pox in healthy districts as compared with towns, where the sanitary conditions are inferior. In proof of this reliance is placed on a comparison of two tables of mortality, showing of what diseases and at what ages a million live-born children might be expected to die, which appeared in a supplement to the 35th annual report of the Registrar-General, the one derived from a Liverpool life-table and the other from a life-table for certain selected "healthy "districts" in different parts of England and Wales. The tables were, in the main, based on the experience of the years 1861–1870, and, of course, assume that the conditions which then obtained would remain unchanged. It is quite true that it appears from these tables that whilst in Liverpool the per-centage of deaths from small-pox expected under 5 years of age was 63·5, in "healthy districts" it was only 25·5. But in order to judge whether this difference (so far as it really represents a different incidence of fatal small-pox on the ages under and over five) can be attributed to the superior sanitary conditions of what are termed the "healthy districts" it is necessary to define what is meant by sanitary conditions and also to see how the case stands with regard to other diseases. A supply of pure water, good drainage, sufficient light and air and cleanliness, these and the like are usually regarded as the elements

which render one area superior to another in its sanitary condition. Different areas may be better or worse in these respects or some of them, and this superiority may largely influence zymotic disease.

But in relation to diseases of this class there are other respects in which a great town differs from rural districts. In the former a large population is collected in close proximity, whilst in rural districts the population is scattered over a wide area, and the people collected in close proximity are comparatively few in number. The necessary effect of this, as we shall presently show, is that the cases of zymotic disease would be more numerous in the former area than in the latter districts, and that as regards certain zymotic diseases, a larger proportion of the deaths would occur under five years of age.

In the case of whooping-cough, according to the tables referred to, whilst the per-centage of deaths under five to be expected in "healthy districts" was 94·2, in Liverpool it was 95·6, or not substantially different. The explanation of this is not far to seek. Whooping-cough rarely causes death in persons over five years of age, the share borne by that class is therefore the same whatever the sanitary condition of the districts in which they occur, though the disease may be more frequently epidemic in large towns than in the country.

Again, if we turn to the heading "fevers," the per-centage of the expected mortality under five is only 12·1 in Liverpool as compared with 9·1 in healthy districts, yet it can hardly be doubted that fever is a form of zymotic disease affected in a special degree by sanitary conditions. It must be remembered, too, that, just as in the case of whooping-cough, the disease is seldom fatal to those above five years of age, in the case of "fevers" the disease is seldom fatal below that age.

Passing now to the headings "measles" and "scarlatina" in the same table, we find in the case of measles the variation in the per-centage borne by children under five is 94·5 in Liverpool, as compared with 76·0 in "healthy districts." It is a disease to which all persons who have not suffered from it are liable, but it is rarely fatal except in the case of the young. In great towns where measles are more frequently epidemic than in rural districts, more children under five years of age will be exposed to the infection of the disease, whilst in districts in which epidemics are not so frequent and the epidemics may occur at intervals of only five years or more, more children will be for the first time exposed to the infection above the age of five years. It was to be expected, therefore, that the proportion of deaths under five years of age would be greater in a large town than in what are termed healthy districts. The same considerations, so far as the recurrence of epidemics is concerned, apply to the case of scarlatina, and the table shows that the per-centage of the expected mortality under five from this disease is in healthy districts 53·1, and in Liverpool 70·0.

A consideration of the facts to which we have been calling attention, appears to us sufficient to show that sanitary conditions do not affect the proportion which the mortality of children under five years of age bears to the total mortality from zymotic diseases unless amongst sanitary conditions that which constitutes the essential difference between towns and rural districts is included. In a town where large numbers are gathered in close proximity the chances of contracting an epidemic disease are necessarily greater than in a rural district where the population is distributed over a wide area in which no large numbers are anywhere living in close proximity. If a difference such as this is to be included amongst sanitary conditions a few badly-drained, ill-ventilated houses remote from other habitations would have to be regarded, as in some respects, in a superior sanitary condition to the best drained and ventilated houses in a large town. A use of the expression "sanitary conditions" which involves such a consequence appears to us to be an abuse of it.

Reverting to the case of small-pox the observations already made in relation to other diseases are, in our opinion, one explanation of the disparity in the expected mortality under five from that disease in Liverpool as compared with healthy districts. In a large town small-pox may be almost constantly present, and frequently become, epidemic. In a country district it may be more rarely present and affect only a particular part of the district. It is to be expected, therefore, that more persons over the age of five years would be susceptible and liable to contract the disease in the case of the latter area than of the former.

In addition to the points to which we have invited attention there is another matter which must be remembered. The comparison made between Liverpool and "healthy "districts" necessarily involves a fallacy unless it be borne in mind that, of a million born alive, a much larger number will attain ages beyond five years in "healthy "districts" than in a large town like Liverpool. The tables referred to show that, whilst in "healthy districts" 175,410 are expected to die below five years of age, in Liverpool the number is no less than 460,370. 824,590 are, therefore, estimated as living beyond the age of five years in "healthy districts" as compared with 539,630 in Liverpool. It is obvious, therefore, that in the case of a disease like small-pox, which attacks and is fatal at all ages, it was to be expected that a much larger proportion of the deaths should occur at ages above five years in "healthy districts" than in Liverpool. In the case of a disease like whooping-cough, which is hardly ever fatal to those above five years of age whether in town or country, the difference in the expected survival beyond that age in the districts compared is of no practical importance. An observation of the same kind applies, though, of course, in a less degree, both to measles and scarlatina. In the case of "fevers," though the cause referred to would lead us to anticipate a larger proportion of deaths above 5 years of age in healthy districts than in Liverpool, the comparison loses much of its value owing to the fact that such a fever as typhus is far more prevalent in a large town like Liverpool than in a "healthy "district;" the "fevers," therefore, which are contracted in the two cases are almost certainly not the same.

198. It has been suggested that the change in the age incidence of small-pox, to which we have referred, is deprived of its importance by the fact that a similar change is to be observed in the case of mortality from "fevers." We have already called attention to the fact that the deaths which have occurred from "fevers" at different times do not admit of the same comparison as the deaths due at different epochs to small-pox owing to changes of nomenclature and diagnosis. Prior to 1869, for example, the term "fever" in the records of the Registrar-General included typhus fever, infantile fever, and remittent fever. Enteric fever was not recognised statistically. There was then a new departure: infantile fever disappeared from the records of the Registrar-General, and remittent fever (so far as children 0–5 were concerned) was classed with enteric fever. Since 1880, however, remittent fever deaths, ages 0–5, have been transferred to malarial diseases. So far we have dealt with classification, but there can be no doubt that in recent years better diagnosis has led to the same disease being returned under a different designation to that which would have been employed at an earlier period. For example, causes of death are now certified as tuberculous which would formerly have been returned as typhoid. But taking the cases of deaths since 1871 recorded as due to typhus and typhoid fevers we find no change of age incidence of the slightest importance until the quinquennium 1881–85. The per-centage of deaths under five to deaths at all ages for four successive quinquennia are as follows:—

——	1871–75.	1876–80.	1881–85.	1886–90.
Typhus - - -	6·4	6·1	3·5	3·4
Typhoid - - -	17·4	16·0	9·3	7·5

It will be seen that not only, as already noted, was there no substantial change until 1881–85, but that the fall was suddenly large, and that since that time there has been no considerable change in the age incidence. The phenomena would certainly seem to point to the conclusion that the change is at all events largely due to the causes already referred to. There has certainly been no change in the age incidence of these diseases which can be said to correspond with the change in the age incidence of small-pox to which we have called attention.

199. It has been suggested that, comparing the deaths registered as due to influenza per million living at separate age-periods during the epidemics of 1847–48 and 1890–91, a change of age-incidence is found parallel to that to which we have called attention in the case of small-pox. A comparison of this kind, relating as it does in each case to the effect of the epidemic in two years only, appears to us of little or no value. Moreover, whilst the comparison shows a considerable diminution in the deaths under 10 years of age in the epidemic of 1890–91, as compared with the epidemic 1847–48, and a small decrease in the case of those between 10 and 15, there was not an increase in the later epidemic in the case of all those above 15 years of age. The increase was great as regards those between 15 and 45 years of age, and there was some increase

up to 65 years of age, but above that age there was again a considerable decrease. In addition to this, it must be borne in mind that during an epidemic of influenza many deaths which have their origin in that disease are ascribed to pneumonia, bronchitis, heart-disease, and other secondary effects of influenza. It is impossible to tell whether in the case of the two epidemics the same proportion of deaths were attributed to these secondary causes, and whether the deaths were thus attributed uniformly at all ages.

200. A comparison has been made of the total share of the small-pox mortality of children under five of all classes with the share of the small-pox mortality of unvaccinated persons borne by children under five years of age, for the quinquennium 1886–1890, for the purpose of showing that the per-centage borne by unvaccinated children does not materially differ from that of all classes at all ages. This comparison is, however, quite valueless, for of the deaths at all ages in the case of more than one half it is not stated whether they were vaccinated or not. Of those in which the condition as to vaccination was not stated, the whole number or the greater part may, as far as appears, have been unvaccinated. Moreover, in the comparison thus made, considerably more than half of the deaths under five of all classes treated as deaths from small-pox were deaths returned as from chicken-pox.

201. Apart from the difference in the extent of vaccination, no cause has been suggested at all adequate to account for the variations in the age incidence of fatal small-pox upon which we have been dwelling. It is not only that it is seen at different epochs equally prominent in England and Wales, Scotland and Ireland, but a striking contrast in the proportion of mortality below and above 10 years of age is witnessed also at the same epoch in different towns where small-pox happened to become epidemic—places which differ, so far as is known, only in this, that the extent of vaccination amongst the child population was different. If improved sanitation were the cause of the diminished mortality amongst children, in proportion to that borne by those of older years, it is quite impossible to understand how its effect should have varied so greatly in these different towns, and why in Gloucester and Leicester the mortality from the disease should have been so largely amongst children, approaching in that respect the experience of the epoch preceding vaccination.

The fatality of small-pox amongst vaccinated and unvaccinated in the six epidemics.

202. We proceed now to consider the evidence derived from a comparison of the fatality of small-pox as it has affected the vaccinated and unvaccinated respectively. The most important information on this head is undoubtedly to be found in the reports upon recent epidemics to which we have already referred. Great pains were taken to ascertain the condition as to vaccination of the persons attacked, and the results are shown, not merely at all ages, but at different age periods. We shall deal, therefore, in the first place with the facts recorded in those reports, though they are later in date than other statistical records which will be noticed hereafter.

203. It may be convenient at the outset to point out that per-centages are of comparatively little value unless the number which is converted into a per-centage be substantial. If, for example, it were found that of two persons attacked, one died, it would be as unsafe to assume that 50 per cent. was the normal fatality of the disease, as it would be, if both died, to assume that it was always fatal, or if neither died, that it never was so. The observation we have made as to the value of per-centages, though stated in this connexion, applies of course to all cases in which per-centages are taken.

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204. Commencing with the earliest of the reports, that relating to Sheffield, we find that at all ages, of 4,151[*] vaccinated persons in the enumerated population of Sheffield attacked by small-pox up to the date of the census, 200, or 4·8 per cent., died of that disease. Of 552[*] unvaccinated persons in the enumerated population attacked by small-pox up to the same date 274, or 49·6 per cent., died of the disease, so that relatively to their number, and apart from any question of age, for each individual vaccinated person suffering from a fatal attack of small-pox, 10·3 unvaccinated persons were fatally attacked by that disease.

Of 353 vaccinated children under 10 years of age in the enumerated population attacked by small-pox up to the same date, 6, or 1·7 per cent., died of the disease. Of 228 unvaccinated children attacked by small-pox up to the same date 100, or 43·9 per cent., died of the disease, so that relatively to their numbers for each individual vaccinated child from 0–10 years of age suffering from a fatal attack of small-pox, 25·8 unvaccinated children were fatally attacked by that disease.

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[*] *Note.—The age of* 24 *of the* 4,151 *vaccinated, and of two of the* 552 *unvaccinated, persons attacked was not ascertained. The figures, therefore, in the second and third paragraphs of* § 204 *do not exactly correspond with those in the first paragraph.*

Of 3,774 vaccinated persons over 10 years of age in the enumerated population attacked by small-pox up to the same date 194, or 5·1 per cent., died of the disease. Of 322 unvaccinated persons over 10 years of age in the enumerated population attacked by small-pox up to the same date 174, or 54·2 per cent., died of the disease, so that relatively to their numbers, for each individual vaccinated person, aged 10 years and upwards, suffering from a fatal attack of small-pox 10·6 unvaccinated persons of a similar age were fatally attacked by that disease. The same features are, broadly speaking, indicated in a comparison of the fatality amongst the vaccinated and unvaccinated in different districts of Sheffield. The per-centages differ somewhat, and in some districts the numbers are too small for a per-centage rate to be of much value, but they all have this feature in common, that the fatality amongst the unvaccinated is distinctly in excess of that amongst the vaccinated.

Q. 19,349–20,200; 20,489–759. 205. The facts recorded by Dr. Barry have been subjected to a severe scrutiny by the opponents of vaccination, but they have not, in our opinion, been materially displaced. It has been shown that three or four of those attacked have been included in the class of unvaccinated who ought to have been placed in the vaccinated class, but, on the other hand, it is probable, as Dr. Barry suggests, that of the doubtful cases which have been included amongst the vaccinated, quite as many ought to have been transferred from the vaccinated to the unvaccinated class. (Q. 29,345.) Many were put in the vaccinated class of whose vaccination there was very meagre evidence. Some, no doubt, may have been vaccinated after the date of the census, in which they were enumerated as unvaccinated. (Q. 29,345–74.) Making full allowance for this, we do not think it would modify the conclusion that the fatality was much higher amongst the unvaccinated than the vaccinated. It is obvious that a considerable transfer might be made from the one class to the other without altering the result in this respect.

App. IV., pp. 2–5, and 12–15. 206. In the outbreak of small-pox in London in 1892–3, of the vaccinated under 10—110 were attacked, none of whom died. Of the unvaccinated of a similar age, 228 were attacked, of whom 61 died, or 26·7 per cent. Of the vaccinated over 10 years of age, 1,643 were attacked, of whom 39 died, or 2·3 per cent. Whilst of 181 unvaccinated of a similar age who were attacked, 38 died, or 20·9 per cent.

Dr. Luff, when comparing in his report the fatality amongst the vaccinated and unvaccinated, dealt only with the persons undoubtedly falling within one or other of those classes, discarding all the doubtful cases. Of these cases 20 were under 10 years of age, with 6 deaths. Over 10 there were 171 cases with 38 deaths. It will be seen that the fatality in these doubtful cases was high, especially amongst those under 10 years of age. The contrast between the fatality in this doubtful class of 20 and that in the class of the undoubtedly vaccinated 110, of whom none died, is very striking. The probability is great that as regards children under 10 years of age, unless where the eruption was such as to obscure the marks, the absence of any mark of vaccination indicates that the operation has never been successfully performed. Adding, however, all these doubtful cases to the vaccinated class the figures are as follows:—

Of the vaccinated under 10, 130 were attacked, of whom 6 died, or 4·6 per cent., as compared with 26·7 per cent. in the unvaccinated class. Of the vaccinated over 10 years of age, 1,814 were attacked, of whom 77 died or 4·2 per cent., as compared with 20·9 per cent. in the unvaccinated class.

App. III., p. 114. 207. In Dewsbury 44 vaccinated children under 10 were attacked, of whom 1, or 2·2 per cent., died. Of 174 unvaccinated children of a similar age, 56, or 32·1 per cent., died. One child under 10 years of age, who did not die, is classed under the heading "alleged vaccination." If this case be added to the vaccinated class, the figures are 45 persons attacked, of whom 1, or 2·2 per cent., died. Of 577 vaccinated persons attacked who were over 10 years of age, 15, or 2·6 per cent., died. Of 192 unvaccinated persons of a similar age attacked, 36, or 18·7 per cent., died. Twenty-four persons over 10 years of age are classed under the heading "alleged vaccination." Of these two died. If the cases thus classified be added to the vaccinated class they would only alter the per-centage to 2·8; the figures being 601 attacks with 17 deaths.

We have thought it well here and elsewhere to include in the unvaccinated class those described as "under vaccination." They appear properly to belong to it, and as their inclusion, though not making a material difference, tells on the whole in favour of the unvaccinated class as compared with the vaccinated, it seems fairer to take that course. Doubtful cases have been included in the vaccinated class.

App. V., pp. 51 and 43. 208. In Warrington, of 33 vaccinated children under 10 years of age, two died, or 6 per cent. Of 32 unvaccinated children of a similar age, 12 died, or 37·5 per cent. Of

560 vaccinated persons over 10 years of age, 36 died, or 6·4 per cent. Of 36 unvaccinated persons of a similar age 12 died, or 33·3 per cent.

209. At Leicester two vaccinated children under 10 were attacked, neither of whom died. Of unvaccinated children of a similar age, 107 were attacked, of whom 15, or 14·0 per cent., died. Of vaccinated persons over 10 years of age, 197 were attacked, of whom two died, or 1·0 per cent. Of the unvaccinated of a similar age, 51 were attacked, of whom four, or 7·8 per cent., died. App. VI., p. 45.

210. At Gloucester 26 vaccinated children under ten were attacked, of whom one, or 3·8 per cent., died. Of unvaccinated children of a similar age 680 were attacked, of whom 279, or 41·0 per cent., died. Of vaccinated persons over ten years of age, 1,185 were attacked, of whom 119, or 10·0 per cent., died. Of the unvaccinated of a similar age, 88 were attacked, of whom 35, or 39·7 per cent., died. App. VII.

211. The history of the disease shows us that small-pox epidemics vary from time to time in the degree of their fatality quite apart from any question of vaccination. If the death-rate in relation to attacks be compared in the six towns, in the case of those over 20 years of age, a class which was in those towns probably in about the same condition as regards vaccination, it will be seen from the following table that the variations were considerable:—

6 Epide
Vacd. &
doubtfu
0 — 10
589 att
16 dea
= 2·7
unvacc
1449 at
523 de
= 36·1
(36·09)

—	Persons over 20 years of age only.		
	Attacks.	Deaths.	Fatality.
Gloucester	962	135	14·0
Sheffield (to date of census)	2,313	253	10·9
Warrington	427	44	10·3
Dewsbury	510	41	8·0
London	1,411	99	7·0
Leicester	180	4	2·2

212. The facts which we have quoted from the reports upon the epidemics in the six towns dealt with, certainly afford strong support to the view that vaccination exerts a powerful influence on the fatality of the disease. It is said that the division into the classes of vaccinated and unvaccinated cannot be relied on as accurate. It is quite possible that the classification may not be strictly accurate, though great pains appear to have been taken to make it so. Doubtful cases were in general included amongst the vaccinated class, and care was taken to see that none should be included in the unvaccinated class except those who properly came within it. Where the doubtful cases were separately stated in the reports we have added them to the vaccinated class for the purpose of our calculations. If all reasonable allowance be made for the possibility of error, it appears to us that the broad result would not be materially altered, and that the contrast between the fatality in the two classes would still be very remarkable.

died
Vacd
1 to

213. It must be remembered that the argument to be derived from these statistics does not depend for its strength upon its being established that there was a strictly accurate discrimination between the vaccinated and unvaccinated. If those who contend that vaccination is altogether inefficacious be correct in their views, the fact that persons have been vaccinated can have no tendency to affect their liability either to be attacked or to die of the disease. Those, therefore, who are selected as being vaccinated persons might just as well be so many persons chosen at random out of the total number attacked. So far as any connexion with the incidence of, or mortality from, small-pox is concerned, the choice of persons might as well have been made according to the colour of the clothes they wore. How comes it, then, that those selected out of the mass merely because, on the hypothesis we are considering, they have been the subjects of a wholly ineffectual or even mischievous proceeding should suffer from attacks of small-pox so much less fatally than the mass from which they are drawn?

214. The figures are worth a closer examination. Taking the six towns together they are large. The unvaccinated attacked amounted to 2,321; of these 822 died, or 35·4 per cent. 1,449 of those attacked were under 10 years of age, of these 523 died, or 36·0 per cent. 870 were over 10 years of age, of whom 299 died, or 34·3 per cent. It is very noteworthy that amongst these persons selected because they were unvaccinated, or believed to be so, the fatality under 10 years of age was 36·0 per cent., over that age 34·3 per cent.; the correspondence between these figures is singularly close.

215. Let us turn now to the mass of cases from which these were selected. It consisted of 11,065 attacks resulting in 1,283 deaths, *i.e.*, a per-centage of 11·5. The cases selected from these as unvaccinated were, as we have seen, 2,321, or 20·9 per cent., of the total number, a large sample in fact drawn from the bulk. Deducting from the total numbers, the attacks and deaths of those said to be unvaccinated, the result is as follows:—2,321 attacks and 822 deaths, or 35·4 per cent. fatality, as we have seen in the class said to be unvaccinated, and 8,744 attacks with 461 deaths, or 5·2 per cent. fatality, in the rest of the population attacked by the disease. How is this to be accounted for?

216. If we direct our attention to the case of children under 10, the result is still more remarkable. The total number of this class attacked in the six towns was 2,038, of whom 539 died, or 26·4 per cent.; 1,449 of these are recorded as unvaccinated, of whom 523 died, or 36·0 per cent.; amongst the remaining 589 the number of deaths was sixteen only, or 2·7 per cent. In cases where the age exceeded 10 years, 9,001 were attacked, of whom 744 died, or 8·2 per cent.; of these, 870 are classed as unvaccinated, of whom 299, or 34·3 per cent., died; deducting these from the total number, the result shown is that of 8,131 attacked, who had been vaccinated, 445, or 5·4, died.

217. Upon the hypothesis, then, that vaccination has no relation to small-pox, and no tendency to mitigate the effect of the disease, we have before us an arbitrary selection which might just as well have been made by drawing lots of 20·9 per cent. of the total number of persons attacked; why should those thus selected display so remarkably different a proportion of fatal cases, a death-rate to attacks of 35·4 per cent. in the one class, and 5·2 per cent. in the other? What reason is there why there should be any substantial difference between the two classes? Or why should not the fatality have chanced to be higher even in the 8,744 cases of attack than in the 2,321? It may be said that children succumb more readily to any illness than adults, and that if there happened to be a larger proportion of children amongst those classed as unvaccinated than amongst the residue of the total number attacked, this would account for some disparity. Even conceding this, it cannot be said, in our opinion, to be an adequate explanation of so vast a difference.

Let us see, then, how the matter stands if child life, up to the age of 10 years, be separately regarded. According to the view we are testing, a selection was arbitrarily made, out of 2,038 cases of children attacked, of 1,449 who were, or were said to be, unvaccinated. Why should the fatality amongst these 1,449 have been 36·0 per cent., whilst amongst the 589, classed as vaccinated, it was 2·7 per cent. only? Why when the children attacked were arbitrarily divided into two classes, 1,449 being placed in the one class, and 589 in the other, should the fatality in the one class have been so enormously greater than in the other? It may be said, and there is some force in the point, that inasmuch as children under three months would almost all be found in the unvaccinated class, whilst the vaccinated would almost all exceed that age, this circumstance would of itself account for a greater fatality in the unvaccinated than in the vaccinated class. It is remarkable that at Warrington, whilst no vaccinated child under one year of age was attacked by small-pox, there were ten such attacks and eight deaths amongst the unvaccinated of that age, all these deaths occurring at the age of one month or under. Although this feature did not characterise the mortality of children under ten years of age in other towns, it will be well, in order to eliminate the suggested distinction between the two classes, to exclude from both classes all children under one year of age. Adopting this classification the result is as follows:—

App. V., p. 54.

CHILDREN of the Age 1–10.

Vaccinated.	Unvaccinated.
Attacks, 570; deaths, 16.	Attacks, 1,235; deaths, 375.
Fatality, 2·8 per cent.	Fatality, 30·3 per cent.

The contrast is the more striking when it is remembered that all the doubtful cases are included in the vaccinated class, though many of them had, in all probability, never been successfully vaccinated. The doubtful cases in London alone account for 6 out of the 16 deaths, and raise the fatality from 1·8 to 2·8 per cent.

Is the different fatality manifested in the two classes into which the children between the ages of one and ten years who were attacked by small-pox are thus divided according as they were or were not vaccinated, a mere freak of chance? It is scarcely possible to believe that it can be so. When it is found that the same contrast is exhibited on comparing the fatality amongst the classes of vaccinated and unvaccinated in each of the six towns with which we have been dealing, and even in different districts of Sheffield and Dewsbury where a similar discrimination between the vaccinated and unvaccinated was made, and when it is borne in mind that both classes lived in the same towns, were of similar ages, and suffered in the same epidemics, it is impossible to believe that there was nothing to distinguish the two classes from one another.

218. The relation of the fatality of the vaccinated to that of the unvaccinated class is not precisely the same in each of the towns. One would not expect it to be so on any hypothesis, but in every case the fatality in the unvaccinated class was very large. The fatality in the unvaccinated class was smallest at Leicester, where, as we have already indicated, the fatality generally was less than in the other towns; even there the fatality in the unvaccinated class under 10 was 14 per cent., whilst there was not a single death amongst the vaccinated class of that age.

219. The conclusion, then, is surely irresistible that some circumstance must have existed distinguishing the class selected as vaccinated from that selected as unvaccinated, and which rendered it less liable to suffer fatally from small-pox. The only condition which regulated the distribution of the cases into the one class or the other was the presence or absence of vaccination. Whatever mistakes may have been made in erroneously including persons in the one class or the other, it cannot be doubted that the great majority of the one class were vaccinated, whilst the great majority of the other class were unvaccinated. Unless, then, some circumstance existed other than the presence or absence of vaccination, which distinguished the two classes and could account for the remarkably different small-pox fatality which characterised them, it would be only reasonable to attribute this difference to vaccination. We will consider presently the causes which have been suggested, other than vaccination, as an explanation of the phenomenon we have been considering.

220. The evidence afforded by the experience in these towns does not stand alone; the same phenomenon of a higher fatality amongst the unvaccinated than the vaccinated had been previously observed.

1832 - 1867

Other observations of the fatality of small-pox amongst vaccinated and unvaccinated.

221. Mr. Marson's observations, made during 32 years in respect of 19,467 cases at the Small-pox Hospital, showed a fatality among the unvaccinated of 36·5 per cent., whilst the highest death-rate amongst those having vaccination marks, viz., those having one vaccination cicatrix only, was 12·8 per cent. We shall have to revert to his figures presently, when considering the question whether various degrees of vaccination differ in their protective effect.

2, App., 243–5.

222. Dr. Gayton furnished us with the results of an examination of 10,403 cases at the Homerton Hospital between the years 1873 and 1884. The deaths amongst the vaccinated (in which class are included those said to be vaccinated, but who had no marks) were 869 out of 8,234, or 10·5 per cent.; the deaths amongst the unvaccinated 43·4 per cent., the numbers being 938 out of 2,169.

So far we have made no discrimination as regards the age of the persons attacked. Out of the total number of 1,807 deaths, 700, *i.e.*, 38 per cent., were under 10 years of age. The fatality of the vaccinated under 10 was 10·4, being 137 out of 1,306. The deaths among the unvaccinated of a similar age were 563 out of 1,187, or a fatality of 47·3 per cent. If the cases of children under one year of age be excluded, the figures are as follows:—In the vaccinated class 1,286 cases with 130 deaths, or a fatality of 10·1 per cent.; in the unvaccinated class 1,032 cases with 465 deaths, or a fatality of 45 per cent.

869
938
1807

Over the age of 10, the fatality of the vaccinated was 10·5, being 732 out of 6,928. The death-rate of the unvaccinated of a similar age was 38·1, being 375 out of 982.

Q. 3689.

223. Mr. Sweeting put before us statistics relating to 2,584 cases at Fulham Hospital between the years 1880 and 1885. Of these 428 died, or 16·5 per cent. The deaths among the vaccinated (in which class are included, as with Dr. Gayton's tables, those said to be vaccinated, but who bore no marks) were 263 out of 2,226, or 11·4 per cent. The deaths amongst the unvaccinated were 165 out of 358, or 46 per cent. Discriminating again with reference to the age of the persons attacked. Of 202 under 10 years of age in the vaccinated class, 16 died, or 7·9 per cent. Of 168 of a similar

age in the unvaccinated class, 78 died, or 43 per cent. The fatality of the vaccinated over 10 years of age was 12·2, being 247 out of 2,024. Of the unvaccinated of a similar age, 87 out of 190, or 45·7 per cent., died.

224. It has been urged against these statistics that, even though every effort were made to classify the cases correctly, the classification was still open to error, inasmuch as persons might be brought to the hospital with the eruption of confluent small-pox upon them, which would prevent the marks even of efficient vaccination being visible. Q. 1,822–6; 3,724–5, 3,728–31. It is true that this might be so in some cases, but both Dr. Gayton and Mr. Sweeting assert that it could have happened very rarely. We do not think that it could make such a difference as to modify substantially the contrast exhibited in the fatality amongst the vaccinated and unvaccinated classes.

225. Inasmuch as the vaccinated class includes, both in the case of Dr. Gayton's and Mr. Sweeting's tables, a considerable number who, though said to be vaccinated, showed no marks, it may be interesting to observe what was the fatality in that class when dealt with separately. It contained in all probability a certain proportion of unvaccinated persons. The fatality in this doubtful class in Dr. Gayton's table was 27·1 2, App., 243–5. per cent., being 352 out of 1,295. Eliminating these cases from the total number hitherto treated as vaccinated the result shown is a fatality of 7·4 per cent., being 517 out of 6,939.

226. Dealing with Mr. Sweeting's statistics in the same manner, we find the Q. 3689. fatality in the doubtful class to be 33 per cent., being 88 out of 266, whilst in the vaccinated class, eliminating these doubtful cases, it is 175 out of 1,960, or 8·9 per cent. It will thus be seen that there is a somewhat striking correspondence in the death-rate shown by this doubtful class in the two cases, and that in each case that death-rate was considerably higher than the fatality in the vaccinated, but considerably lower than that in the unvaccinated class.

227. The statistics to which we have been directing attention have been subjected to criticism on the ground that they show a much higher death-rate in proportion to attacks amongst the unvaccinated class than was shown by records of small-pox mortality prior to the introduction of vaccination. The objection is chiefly founded upon the statistics collected by Dr. Jurin. We have already pointed out (§ 53) that these statistics cannot be relied on as establishing a normal fatality of small-pox in the epoch preceding the introduction of vaccination, as there was a great difference in the fatality of the epidemics from which the statistics were compiled. It seems well established that the fatality of small-pox varies greatly in different epidemics. The statistics given in the preceding paragraphs in our Report will show that in the local epidemics, with which we have specially dealt, the fatality among the unvaccinated cases exhibited very considerable variations. At Sheffield it was as high as 49·6 per cent., in Warrington it was 35·2, in Dewsbury 25·1, in London 24·2, in Leicester 12·0, and in Gloucester 40·8 per cent. At all events, the fact, or alleged fact, on which the criticism is founded, cannot be regarded as a proof that the classification into vaccinated and unvaccinated has not been accurately carried out.

228. We have already called attention in dealing with the statistics of the six towns to the improbability that a selection, solely on the ground of the presence or absence of vaccination, should by mere chance show so remarkably different a fatality in the two classes. That argument is strengthened when we see the same results exhibited on a division into vaccinated and unvaccinated, of 10,403 cases in the Homerton Hospital, and 2,584 cases in the Fulham Hospital, and when we find, comparing the death-rate of the vaccinated in the two hospitals, that in the former it was 10·5 per cent. and in the latter 11·4 per cent., and that, making a similar comparison of the unvaccinated classes, in the former it was 43·4 per cent., in the latter 46 per cent.

229. We proceed to consider the explanations of the contrast between the fatality of small-pox in the case of the vaccinated and the unvaccinated which have been suggested by those who deny that it is due to vaccination. It has been said, and this is the main argument employed, that the unvaccinated are mostly to be found in the poorer and more neglected classes of the population, who would on that account be constitutionally weaker and less able to resist an attack of small-pox and to escape a fatal result. Speaking generally, this may be to some extent true, though it is not so at all times and in all places. There are facts stated in the reports we have so often quoted, especially those relating to Warrington, Dewsbury, Leicester, and Sheffield, and in the evidence with reference to the last-named town, which seem to show that the explanation

suggested cannot be the correct one. In the report on the Warrington epidemic, as we shall see immediately, it is expressly stated that the vaccinated and unvaccinated were of the same class and lived in the same houses and in the same manner. Moreover, the persons admitted into the Homerton and Fulham Hospitals were for the most part, whether vaccinated or unvaccinated, of the pauper class or of the class immediately above it. It is not conceivable that in this section of the population the presence of vaccination or its absence should indicate so marked a difference of constitutional strength as to account for the difference of small-pox fatality which we are now considering. It is further to be observed that, taking the statistics of the six towns, in the case of the vaccinated aged 1–10 the fatality was 2·8 per cent., in the case of the unvaccinated of a similar age it was 30·3 per cent., whereas in the case of those over 10 years the fatality in the case of the vaccinated was 5·4 per cent., in the case of the unvaccinated 34·3. It will be seen, therefore, that the disparity in the death-rate of those classed as vaccinated and unvaccinated was greater nearer the date of vaccination than it was at a later period. The same phenomenon is observable in the hospital statistics. We do not think it possible, then, to accept the suggestion that there were more of the poor in the unvaccinated than in the vaccinated class as a sufficient explanation of the contrast we have been considering. The difference of fatality in the two classes is, in our opinion, far too great to be thus accounted for, and the suggested explanation does not explain all the phenomena. We should think it much more reasonable to conclude that the remarkable difference of fatality was due to vaccination, even if it were only in that respect that the two classes differed in their relation to small-pox. But this is not the case. There are other points of distinction between the two classes. We are about to discuss the differences they exhibit both in the liability to be attacked by small-pox and in the type of the disease from which they suffer. And the bearing of these facts upon the question whether the smaller fatality in the vaccinated class is due to vaccination, which is obviously important, will afterwards be considered.

App. V., p. 26.

230. Another explanation given of the greater fatality which characterises the unvaccinated class has been that, inasmuch as the unvaccinated class includes those whose vaccination has been postponed for medical reasons, there would be amongst its number a larger proportion of children of delicate constitution who would on that account be more likely to succumb to an illness. With reference to this argument, it is to be observed in the first place that the number of those whose vaccination is postponed for medical reasons is but small, and in the next place that the postponement by no means necessarily shows that the child is of a delicate constitution. It often results from the presence of some ailment to which young children are subject, and which affects the strong no less than the weak. But besides this it must be remembered that those whose vaccination is postponed are frequently vaccinated at a later period, and thus pass from the class of the unvaccinated to that of the vaccinated. Giving due weight to these considerations, we find it impossible to believe that the cause suggested can account to any material extent for the difference to which we have been adverting between the fatality among children under 10, observed in the classes of vaccinated and unvaccinated. It must always be borne in mind that the difference is not a narrow one, it is not measured by a small per-centage. A broad margin might be allowed for error without the force of the argument derived from the contrast being seriously diminished.

The attack-rate of small-pox amongst vaccinated and unvaccinated in the six epidemics.

231. The next point for consideration is the question whether the evidence shows that vaccination has a protective effect against an attack of small-pox. We have lately been considering whether it affords any protection against death from the disease in persons attacked by it. The question with which we have now to deal obviously presents greater difficulty in arriving at accurate results. The liability to attack depends on contact with or proximity to sources of infection. When an epidemic of small-pox visits a town, the liability to infection of the inhabitants of different parts of the town may differ widely. Those who are residing in a house where a person is suffering from small-pox are subject to a risk which does not attach to persons living in a house not so invaded. On the other hand, persons moving about the town, or congregating for purposes of business or pleasure may come in contact with sources of contagion, so that the risk of contagion is, of course, not confined to those who are living in a house where small-pox is present, though it may be greater in the case of this class than of the rest of the community. These considerations appear to have been kept in view by the medical men who have dealt with the matter in their reports on the local epidemics to which we have so often referred.

Q. 1961, 1963. 232. The following results are derived from an analysis of the returns relating to the total population enumerated in the census taken at Sheffield, which we have already mentioned :—

Of 268,397 persons of all ages returned as vaccinated 4,151, or 1·55 per cent., had been attacked by small-pox.

Of 5,715 persons of all ages returned as unvaccinated 552, or 9·7 per cent., had been attacked by small-pox.

Of 68,236 vaccinated children under 10 years of age 353, or 0·5 per cent., had been attacked.

Of 2,259 unvaccinated children under 10 years of age 228, or 10·1 per cent., had been attacked.

Of 196,905 vaccinated persons aged 10 years and upwards 3,774, or 1·9 per cent., had been attacked.

Of 3,429 unvaccinated persons aged 10 years and upwards 322, or 9·4 per cent., had been attacked.

These results have been subjected to criticism on the ground that in the case of many of the persons classed as vaccinated the operation was performed in the course of the epidemic only; that at its commencement, and it may be for a considerable time afterwards, they belonged to the unvaccinated class; and that this transfer of them to the class of vaccinated persons renders the attack-rate amongst the unvaccinated, shown by the figures, higher than it really was. Dr. Barry furnished us with particulars of the number of these returned as vaccinated and unvaccinated in particular districts, from which it appeared that if the persons vaccinated during the progress of the epidemic were added to the unvaccinated class its numbers would be increased by about 28 per cent. In his opinion the proportion of persons vaccinated during the epidemic in the districts referred to was probably at least equal to the proportion passing from the unvaccinated to the vaccinated class in the town generally. Q. 29,333–43.

In order to meet the objection made we have thought it well to modify the figures by adding in all cases 28 per cent. to the numbers of the unvaccinated, and by deducting from the vaccinated the numbers added to the unvaccinated classes. The result of these changes will appear from the following figures :—

Of 266,797 vaccinated persons of all ages 4,151, or 1·55 per cent., were attacked by small-pox.

Of 7,315 unvaccinated persons of all ages 552, or 7·5 per cent., were attacked by small-pox.

Of 67,603 vaccinated children under 10 years of age 353, or 0·5 per cent., were attacked.

Of 2,892 unvaccinated children under 10 years of age 228, or 7·8 per cent., were attacked.

Of 195,945 vaccinated persons aged 10 years and upwards 3,774, or 1·9 per cent., were attacked.

Of 4,389 unvaccinated persons aged 10 years and upwards 322, or 7·3 per cent., were attacked.

It will be noticed that the contrast remains very striking, and that it would be scarcely less so even if a considerably larger transfer were made from the vaccinated to the unvaccinated classes.

233. It is not necessary to give the figures, separately, for each of the nine districts, into which Sheffield is divided, but it may be stated that in each of them the same feature appears of a much higher rate of attack among the unvaccinated than among the vaccinated.

234. So far the comparison has been made between the classes of vaccinated and unvaccinated which together formed the entire enumerated population of the town without reference to any circumstance which might render any of them specially liable to attack. We turn now to the state of the case in the houses invaded by small-pox.

Q. 1963–5. Of the 18,020 vaccinated persons of all ages enumerated as living in invaded houses 4,151, or 23·0 per cent., had been attacked.

Of the 736 unvaccinated persons of all ages enumerated as living in invaded houses 552, or 75·0 per cent., had been attacked.

Of 4,493 vaccinated children under 10 years of age 353, or 7·8 per cent., had been attacked.

Of 263 unvaccinated children under 10 years of age 228, or 86·9 per cent., had been attacked.

Of 13,435 vaccinated persons aged 10 years and upwards 3,774, or 28·1 per cent., had been attacked.

Of 469 unvaccinated persons aged 10 years and upwards 322, or 68·6 per cent., had been attacked.

Treating these figures in the same way as we did those relating to the attack rate in the case of the population generally, by making a similar transfer from the vaccinated to the unvaccinated classes, we obtain the following results:—

Of the 17,814 vaccinated persons of all ages living in invaded houses 4,151, or 23·3 per cent. were attacked.

Of the 942 unvaccinated persons of all ages living in invaded houses 552, or 58·6 per cent. were attacked.

Of 4,419 vaccinated children under 10 years of age 353, or 7·9 per cent. were attacked.

Of 337 unvaccinated children under 10 years of age 228, or 67·6 per cent. were attacked.

Of 13,304 vaccinated persons aged 10 years and upwards 3,774, or 28·3 per cent. were attacked.

Of 600 unvaccinated persons aged 10 years and upwards 322, or 53·6 per cent. were attacked.

235. It will be seen that, as was to be expected, the proportion attacked in each class was much higher than when we were dealing with the total enumerated population, but the contrast between the attack-rate of the unvaccinated and vaccinated classes is not less remarkable. We may observe, too, that the same contrast is seen if the attack-rate in the invaded houses in each of the districts of Sheffield is separately examined.

236. We pass on to consider the information, bearing on the question with which we are dealing, afforded by the report on the Warrington epidemic. With reference to the inhabitants of houses invaded by small-pox during the epidemic at Warrington, Dr. Savill states that bearing in mind the social class affected with small-pox, it may be taken as nearly certain that all the inmates of an infected house were exposed in some degree to infection either before or after recognition of the disease, either from the patient, or from the same source as the patient. App. V., p. 26.

The number of these infected houses was 457, but as regards 20 of them precise information could not be obtained as to inmates other than those who contracted small-pox. In the remaining 437 infected houses, there resided 2,535 persons, of whom 41 were stated to have had small-pox in previous years. Amongst the other 2,494 inmates, there were 2,387 persons who were classed as having been vaccinated at some time of their lives, before the house became infected. Of these 553, or 23 per cent., were attacked by small-pox. Included in this calculation there are 100 persons about whose vaccination Dr. Savill was unable to satisfy himself. On the information before him, some of them might or might not have been vaccinated. App. V., pp. 22, 26 and 27.

In the same houses were found 107 unvaccinated persons, and of these 60 or 56·0 per cent. were attacked.

237. Of the 2,535 people in these infected houses, 688 were of the ages 0–10. Of these 633 were vaccinated, and 55 unvaccinated. App. V., p. 49

Of the 633 vaccinated children, 28 were attacked, or 4·4 per cent.

Of the 55 unvaccinated children, 30 were attacked, or 54·5 per cent.

Those over 10 years of age were 1,847 in number, of whom 560 were attacked. Excluding the 41 persons who were stated to have previously had small-pox (five of whom were again attacked), there remain 1,806 persons, of whom 555 were attacked. Of the 1,806, there were 1,754 vaccinated and 52 unvaccinated.

Of the 1,754 vaccinated persons over 10 years of age, 525 were attacked or 29·9 per cent.

Of the 52 unvaccinated persons over 10 years of age, 30 were attacked or 57·6 per cent.

238. With reference to the contrast between the attack rate in the case of the vaccinated and of the unvaccinated living in infected houses, Dr. Savill says: "I could "ascertain no reason for this remarkable difference in the attack rate in the two "classes, unless the fact of vaccination protected the vaccinated persons from being "attacked by small-pox. Being members of the same families, they lived in the same "houses (which, be it noted, were of a remarkably uniform type), ate the same food, "often did the same work, and were exposed to the same hereditary and external "influences." App. V., p. 26.

App. V., pp. 24 and 27.

239. Another comparison bearing on the same point is to be found in Dr. Savill's report. It relates to the population in a highly infected area which he calls "The 300 "yards Akin Street area." This area contained a population of 3,394 persons (or 3,330, excluding those who were stated to have had small-pox in previous years), of whom 29 only were unvaccinated. Among the 3,301 persons forming the vaccinated class (including as elsewhere doubtful vaccination) there were 84 attacks, being 2·5 per cent., whilst in the unvaccinated class of the same population there were 6 attacks, being 20·6 per cent.

App. III., pp. 2 and 124.

240. We turn now, with reference to the same point, to a consideration of Dr. Coupland's report on the Dewsbury epidemic. In the course of the outbreak 648 houses were invaded, but Dr. Coupland was only able to obtain information on this point as regards 544 of them. In these 544 infected houses, which contained 3,000 inhabitants, there were 2,315 * vaccinated persons, including cases of alleged vaccination. Of these 568 were attacked, the rate being 24·5 per cent.

Of unvaccinated persons in these infected houses there were 605, including as before persons described as "under vaccination." Of these 315 were attacked, or 52·0 per cent.

241. Discriminating according to ages:—

Of vaccinated persons under 10 years of age there were 408, of whom 42 were attacked, or 10·2 per cent.

Of unvaccinated persons under 10 there were 311, of whom 158 were attacked, or 50·8 per cent.

Of vaccinated persons over 10 years of age there were 1,896, of whom 526 were attacked, or 27·7 per cent.

Of unvaccinated persons over 10 years of age there were 294, of whom 157 were attacked or 53·4 per cent.

App. VI., 46 and 62.

242. In his investigation of the Leicester epidemic, Dr. Coupland scrutinised in the same manner the relation which the attacks of the vaccinated bore to those of the unvaccinated.

Of 1,229 persons in invaded houses (320 of whom were attacked with small-pox) 841 † were vaccinated, of whom 170 were attacked, a rate of 20·2 per cent., whereas 388 were unvaccinated, of whom 150 were attacked, a rate of 38·6 per cent.

Of vaccinated persons under the age of 10 years there were 78, of whom 2 were attacked, a rate of 2·5 per cent.

Of the unvaccinated under the age of 10 there were 283, of whom 100 were attacked, a rate of 35·3 per cent.

Of those over 10 years of age, 754 were vaccinated, of whom 168 were attacked, or 22·2 per cent.; 105 were unvaccinated, of whom 50 were attacked, or 47·6 per cent.

The figures given require to be slightly modified if those who were stated to have had small-pox prior to the outbreak be eliminated; there were in all 19 such persons, none of whom suffered from small-pox on this occasion. Twelve of them were vaccinated, and five unvaccinated, and as to the vaccinational condition of the other two there is no information. Eliminating these cases, the rate among the vaccinated over ten would be raised to 22·6 per cent., and amongst the unvaccinated to 50 per cent. As they were all individuals above the age of 30 years, the attack rates in the age period 0 to 10 would not be altered.

App. VII.

243. In the case of the epidemic at Gloucester, Dr. Coupland was only able to obtain information, with reference to this point, as to 899 out of a total of 1,097 invaded houses. There is, however, no reason to believe that the conditions were materially different as regards the other 198 houses invaded by small-pox.

In the 899 houses there resided 4,861 persons. Of these 3,386 had been vaccinated at some time in their lives before their house became infected, including all those in whose case there was any doubt as to whether or not they had been vaccinated. The remaining 1,475 were unvaccinated at the time their house became infected, though a considerable proportion of them (those described as "under vaccination") were subsequently vaccinated.

Of the 3,386 persons forming the vaccinated class, 1,028, or 30·3 per cent., were attacked. Of the 1,475 persons forming the unvaccinated class, 689, or 46·7 per cent., were attacked.

244. In the vaccinated class there were 272 children under 10 years of age, of whom 24, or 8·8 per cent., were attacked.

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* *Note.—The age of eleven of these* 2,315 *vaccinated persons was not ascertained.*

† *Note.—The age of nine of these* 841 *vaccinated persons was not ascertained.*

In the unvaccinated class there were 1,331 children under 10, of whom 617, or 46·3 per cent., were attacked.

In the vaccinated class there were 3,114 persons over 10 years of age, of whom 1,004, or 32·2 per cent., were attacked.

In the unvaccinated class there were 144 persons over 10, of whom 72, or 50 per cent., were attacked.

245. In the reports on the Sheffield, Dewsbury, and Leicester epidemics other data are given for the purpose of enabling a comparison to be made of the attack-rate in the classes of vaccinated and unvaccinated persons. It is not necessary to state here the details to be found in the reports, it is sufficient to say that they all indicate an attack-rate amongst the unvaccinated markedly in excess of that found in the class of vaccinated persons.

246. It is worth special notice that in all these cases the contrast between the attack-rate of the classes of vaccinated and unvaccinated respectively is much more striking in the case of children under 10 years of age than in the case of those over that age.

This will be seen by a glance at the following table :—

—	Attack Rate under 10.		Attack Rate over 10.	
	Vaccinated.	Unvaccinated.	Vaccinated.	Unvaccinated.
Sheffield - - - - - -	7·9	67·6	28·3	53·6
Warrington - - - - -	4·4	54·5	29·9	57·6
Dewsbury - - - - - -	10·2	50·8	27·7	53·4
Leicester - - - - - -	2·5	35·3	22·2	47·6
Gloucester - - - - -	8·8	46·3	32·2	50·0

London + G [illegible]

App. IV., pp. 2, 5, 12 and 15.

247. In his report upon the outbreaks in London during 1892 and 1893 Dr. Luff has not entered into the question of the rate of attack among the unvaccinated as compared with the vaccinated. His report, nevertheless, affords some data for such a comparison. Of a total number of 2,353 cases as to which he obtained information there were 409 unvaccinated persons, or 17·3 per cent. It is not likely that the per-centage of unvaccinated persons, whether in London or in the districts specially affected, was as great as this.

Dealing with the age period 0–10, there were 358 attacks.

Of the persons thus attacked, 228 were unvaccinated, or a per-centage of 63·7.

It is not open to doubt that this was greatly in excess of the per-centage of unvaccinated persons under 10 years of age in London or in any part of it.

Other facts as to the attack-rate of small-pox amongst vaccinated and unvaccinated.

248. Turning now to the statistics of small-pox in London hospitals supplied by Dr. Gayton and Mr. Sweeting, we find that the per-centage of unvaccinated persons treated in the Homerton Hospital was 20·8 ; the numbers being 2,169, out of 10,403. Of children under 10 years of age the number of unvaccinated admitted was 1,187, out of 2,493, or 47·6 per cent.

At the Fulham Hospital 358 was the number of admissions of unvaccinated persons, out of a total of 2,584, the per-centage being 13·8.

Out of the total number of 370 children under 10 years of age admitted to the hospital 168, or 45·4 per cent., were unvaccinated. It will be remembered that all those who were said to be vaccinated, even though they showed no marks of it, were excluded from the unvaccinated class.

When these figures are examined they show a proportion of unvaccinated persons, especially children, admitted to the hospital which it is impossible to believe corresponded with the proportion of unvaccinated persons existing in the population of London or of any district of it.

249. It has been suggested that the inmates of these hospitals were drawn from the poorer class of the population, and that in that class there would be a larger proportion of unvaccinated persons than in the population at large. This, probably, is so to some extent. But it seems to us quite inadequate as an explanation of the very large proportion of unvaccinated children admitted to the hospitals. When the returns of vaccination in London are examined it will be seen that the children not finally accounted for between the years 1872 to 1884 had only ranged from 9·3 of the births in 1874 to 5·7 in 1881, the average for those 13 years being but 7·4.

250. Our attention has been called to the fact that the proportion of vaccinated patients admitted to the Highgate Small-pox Hospital has often been as high as 94 or 95 per cent. And it has been suggested that this indicates an attack-rate in London in the class of vaccinated persons quite as high as that prevailing in the case of the unvaccinated. The experience at the Highgate Hospital certainly differs greatly from that of either Homerton or Fulham. The test was a larger one in point of number at the two latter hospitals than at the former. Moreover, the fact mentioned in the preceding paragraph must be borne in mind. In London the absence of vaccination is to be found chiefly in the poorer classes of the population. The inmates of the Highgate Hospital belonged in part to a more prosperous class. In that class the cases of non-vaccination would be very rare. Moreover, those who were admitted by contract with the Guardians of different Unions came from areas outside London. It will not do, therefore, to estimate what was the proportion of vaccinated and unvaccinated persons in the population of London when considering whether the unvaccinated contributed more than their share of the inmates of the Highgate Hospital.

251. We think, taking it all together, that the evidence bearing upon the question whether the vaccinated are less liable to be attacked by small-pox than the unvaccinated, points to two conclusions; first, that there is, taking all ages together, less liability to attack among the vaccinated than among the unvaccinated, and next, that the advantage in this respect enjoyed by vaccinated children under 10 years of age is greatly in excess of that enjoyed at a more advanced period of life.

We have been able to add the experience derived from the recent epidemic in Gloucester to that of the other five towns so far as regards the age incidence, fatality, and attack-rate of the disease. The combination of the Gloucester cases with those derived from other towns increases the total by more than 20 per cent. It is a striking fact that the addition of these cases, though it has necessitated some small changes in the per-centages to which attention is called, has not rendered necessary any other alteration of the paragraphs, which were already in type when we received the Gloucester figures. All the contrasts which presented themselves when the combined figures of the other five towns were considered, are just as striking when the Gloucester figures are added.

It has not been possible for us to deal with the facts disclosed by the Gloucester epidemic in other respects than those alluded to, without delaying the presentation of our Report, which appeared to us undesirable.

The severity of type of small-pox amongst vaccinated and unvaccinated in five of the six epidemics.

252. It is alleged that vaccination not only diminishes the risk of attack by small-pox and the fatality of that disease, but that it renders the type of the disease in the vaccinated less severe than it would have been had they remained unvaccinated.

Small-pox differs greatly in the degree of its severity. It may be an illness of a very serious character, entailing grave after consequences, or it may be a comparatively trifling ailment. The most severe forms of the disease have been termed malignant or hæmorrhagic. Next in severity comes the confluent type, which is also of a very serious character. The mildest species of the disease has been termed varioloid, or sometimes simply "mild." Between the confluent and the mild or varioloid come in order of severity the coherent and the discrete types.

Quite apart from the danger of a fatal termination to the illness, it is obviously a matter of great importance to those who suffer from the disease that its type should in their case be of a mild rather than of a severe character, not merely because the illness is in the one case trifling and in the other painful and prolonged, but because evil consequences such as pitting of the countenance often follows in the one case which in the other are absent. It is important, then, to test the validity of the assertion that vaccination has this beneficent influence, and that for two reasons. If it can be established it would show, first, that vaccination carries with it this distinct advantage independently of the others we have been considering; and next, it would add support to the view that vaccination has an influence upon the disease of small-pox, a point which has been contested. Let us inquire, then, what light the evidence throws upon the claims thus advanced in favour of vaccination.

Q. 2018-9.

253. Commencing with Sheffield:—Of 825 vaccinated persons in the Borough Hospital in Winter Street during the 1887-88 epidemic:—

293, or 35·5 per cent. suffered from the varioloid type,
413 ,, 50·0 ,, ,, discrete type,
107 ,, 13·0 ,, ,, coherent type, and
12 ,, 1·5 ,, ,, confluent type.

Of 280 unvaccinated persons in the same hospital—
None had the varioloid type.
50, or 17·9 per cent. suffered from the discrete type,
175 „ 62·5 „ „ coherent type, and
55 „ 19·6 „ „ confluent type.

Dealing now with those under 10 years of age:—
Of 27 vaccinated children—
22, or 81·5 per cent. had the varioloid type.
5 „ 18·5 „ „ discrete type.
Of 67 unvaccinated children—
None had the varioloid type.
13, or 19·4 per cent. had the discrete type.
50 „ 74·6 „ „ coherent type.
4 „ 6·0 „ „ confluent type.

254. It will be observed that in the case of the vaccinated children the disease was in all cases of one or other of the milder forms, varioloid or discrete, the great majority of them being of the mildest form, viz., varioloid. In the case of the unvaccinated, on the other hand, the great majority of the cases were of the severer forms, viz., coherent and confluent, and not one was of the mildest form, varioloid.

255. The type of the disease was examined in the same way in the other Sheffield hospitals. The numbers were, however, much less than in the Winter Street Hospital, and too small in each hospital to make a per-centage of each type of the disease of value. The varioloid and the discrete on the one hand, and the coherent and confluent on the other, were therefore classed together.

256. There were in these other hospitals a few cases of vaccinated children whose disease fell within the confluent and coherent class. It may be well, therefore, to state the result if the whole of the cases in the Sheffield hospitals are taken together. Q. 2019.

There were 1,298 vaccinated persons, with regard to whose cases the type of disease was recorded. Of these 1,075, or 82·8 per cent., suffered either from the varioloid or discrete type, and 223, or 17·2 per cent., from the coherent or confluent type.

The number of unvaccinated patients in the hospitals, with regard to whose cases the type of disease was recorded, was 443; of these, 82, or 18·5 per cent., suffered from either the varioloid or discrete type, and 361, or 81·5 per cent., from the confluent or coherent type.

257. It will thus be seen that the relation which the severe and milder forms of the disease bore to one another in the two classes was almost exactly reversed. The proportion of the severer type in the case of the unvaccinated was nearly the same as the proportion of the milder type in the case of the vaccinated.

No mention is made of hæmorrhagic cases; if there were any such, they were, no doubt, included under the class "confluent."

258. Dealing next with the Dewsbury Report, Dr. Coupland classed the cases he investigated under the headings "confluent," "coherent," "discrete," and "mild." In 273 cases placed under the heading confluent, three were included which were also hæmorrhagic. Dr. Coupland ascertained the per-centage of attacks of the different types, according as they occurred among the vaccinated, the unvaccinated, those alleged to be vaccinated, and those who were undergoing vaccination. It may, perhaps, be thought a fairer test with respect to the point under consideration if, as before, we class those alleged to have been vaccinated with the vaccinated, and those undergoing vaccination with the unvaccinated, though the numbers of those alleged to be vaccinated and of those undergoing vaccination are small, and it does not make a substantial difference. Treating the case in this fashion, those vaccinated or alleged to have been vaccinated (whom we shall hereafter call the vaccinated) amounted to 644. The unvaccinated and those described as undergoing vaccination (whom we shall hereafter term the unvaccinated) were 364 in number. App. III., pp. 134–7.

Of the vaccinated there suffered—

From the confluent type 53, or 8·2 per cent.
„ coherent „ 63 „ 9·8 „
„ discrete „ 268 „ 41·6 „
„ mild „ 260 „ 40·4 „

Of the unvaccinated there suffered—

From the confluent type 219, or 60·2 per cent.
„ coherent „ 61 „ 16·8 „
„ discrete „ 63 „ 17·3 „
„ mild „ 21 „ 5·8 „

259. Dealing separately, now, with the case of children of the age 0–10. Of the 45 vaccinated cases—

2, or 4·4 per cent., were confluent.
0 „ coherent.
9 „ 20·0 „ „ discrete.
34 „ 75·6 „ „ mild.

There was only one case of either the confluent or coherent type among the class undoubtedly vaccinated, the other confluent case was among those alleged to have been vaccinated.

Of the 171 unvaccinated cases—

94, or 55·0 per cent., were confluent.
26 „ 15·2 „ „ coherent.
35 „ 20·5 „ „ discrete.
16 „ 9·4 „ „ mild.

App. VI., pp. 45–6.

260. Reviewing next the information on the same point afforded by Dr. Coupland's report on the Leicester epidemic, and including as before the cases described as under vaccination among the unvaccinated, and the cases described as doubtful vaccination among the vaccinated, we find the following results:—

Of the 199 vaccinated cases—

17, or 8·5 per cent., were confluent.
20 „ 10·1 „ „ coherent.
50 „ 25·1 „ „ discrete.
112 „ 56·3 „ „ mild.

Of the 158 unvaccinated cases—

79, or 50·0 per cent., were confluent (including malignant).
36 „ 22·8 „ „ coherent.
28 „ 17·7 „ „ discrete.
15 „ 9·5 „ „ mild.

261. Dealing again separately with children aged 0–10, there were only two vaccinated children attacked, and both suffered from the mild type of the disease.

Of the 107 unvaccinated cases—

54, or 50·5 per cent., were confluent (including the malignant).
23 „ 21·5 „ „ coherent.
20 „ 18·7 „ „ discrete.
10 „ 9·3 „ „ mild.

App. IV., pp. 2–5 and 12–15.

262. From Dr. Luff's report on the outbreaks in London we obtain the following information. His classification is somewhat different; he divides the cases into "very "mild," "discrete," "severe discrete," "confluent," and "hæmorrhagic." The cases in the latter class are very few in number, and it will be more convenient to class them with the confluent cases.

The number of cases in which the type of disease was discriminated was 2,353, of whom 1,944 were vaccinated or doubtful and 409 unvaccinated.

Of the 1,944 vaccinated cases—

108, or 5·6 per cent., were very mild.
1,622 „ 83·4 „ „ discrete.
32 „ 1·6 „ „ severe discrete.
182 „ 9·4 „ „ confluent.

Of the 409 unvaccinated cases—

2, or 0·5 per cent., were very mild.
142 „ 34·7 „ „ discrete.
64 „ 15·6 „ „ severe discrete.
201 „ 49·1 „ „ confluent.

263. Separating now children under 10 years of age:—

Of the 130 vaccinated cases—

30, or 23·1 per cent., were very mild.
83 „ 63·8 „ „ discrete.
4 „ 3·1 „ „ severe discrete.
13 „ 10·0 „ „ confluent.

Of the 228 unvaccinated cases—

1, or 0·4 per cent., was very mild.
84 „ 36·8 „ were discrete.
45 „ 19·7 „ „ severe discrete.
98 „ 43·0 „ „ confluent.

264. In Warrington, Dr. Savill reports on the type of disease in 661 cases, of which 593 were vaccinated or doubtful; 68 unvaccinated cases. He includes amongst the confluent cases those which were malignant or hæmorrhagic. App. V., pp. 51 and 43.

Of the 593 vaccinated cases—

323, or 54·5 per cent., were mild.
141 „ 23·8 „ „ discrete.
129 „ 21·8 „ „ confluent.

Of the 68 unvaccinated cases—

3, or 4·4 per cent., were mild.
17 „ 25·0 „ „ discrete.
48 „ 70·6 „ „ confluent.

265. Separating the cases of children aged 0–10, 33 of them were vaccinated and 32 unvaccinated.

Of the 33 vaccinated cases—

24, or 72·7 per cent., were mild.
7 „ 21·2 „ „ discrete.
2 „ 6·1 „ „ confluent.

Of the 32 unvaccinated—

2, or 6·2 per cent., were mild.
7 „ 21·9 „ „ discrete.
23 „ 71·9 „ „ confluent.

266. A somewhat closer examination of the distribution of the different types of disease is of importance.

Although the per-centages are not identical in the different towns there is a noteworthy correspondence in them, as will be seen from the following table. We have divided the cases into two classes. The one comprising the milder types—varioloid, or mild and discrete; the other the more severe forms—coherent and confluent.

—		Milder.	Severer.
Sheffield	Vaccinated	82·8	17·2
	Unvaccinated	18·5	81·5
Dewsbury	Vaccinated	82·0	18·0
	Unvaccinated	23·1	76·9
Leicester	Vaccinated	81·4	18·6
	Unvaccinated	27·2	72·8
Warrington	Vaccinated	78·2	21·8
	Unvaccinated	29·4	70·6

It will be seen that in the case of the vaccinated the proportion of milder cases is very similar. It ranges only from 7·82 per cent. at Warrington to 82·8 per cent. at Sheffield, and the figures relating to Sheffield, Dewsbury, and Leicester are remarkably alike, viz., 82·8, 82·0, and 81·4 per cent. The variations in the per-centages showing the proportion of milder to severer cases in the unvaccinated class are somewhat greater, though even these are comparatively unimportant. They range from 29·4 per cent. at Warrington to 18·5 per cent. at Sheffield.

78·2

267. In London a different classification of the types of disease renders comparison less easy. If, however, the severer class be composed of the severe discrete and the confluent, the milder class as before consisting of the mild and discrete, the result is as follows:—

—		Milder.	Severer.
London	Vaccinated	89·0	11·0
	Unvaccinated	35·2	64·8

268. If the proportion which the mild bear to the severe cases in those under ten years of age be examined, it will be seen that in the vaccinated class the ratio of the milder type is much greater than at all ages, indeed, the proportion of severer cases is in all the towns quite insignificant.

269. Before passing to another branch of the subject it will be well to take account of the bearing upon one another of the facts relating to the fatality, the attack-rate, and the type of the disease of small-pox, which we have been considering. Between the facts with which we have been concerned when investigating the fatality of small-pox and those which have engaged our attention when considering the type of the disease, the connexion is obvious and intimate.

In each of these cases we have had to deal with the same classes of vaccinated and unvaccinated persons—indeed, we may say with the very same persons—we have already pointed out that it is more than improbable that on a division of the persons who suffered from small-pox, into two such classes the fatality should be so strangely different unless there were something in the condition of the one class which differentiated it from the other and rendered those within it less liable to suffer fatally from the disease. What is to be said when it is found that apart from the fatality of the disease, its type in the two classes also differs, and perhaps even more widely, than its fatality does, and that the milder type distinguishes the same class which exhibits the smaller fatality? That this should be a mere chance coincidence is incredible when it is observed that the phenomenon is uniform not only in the case of epidemics in five different towns, but in the case of the same epidemic in different parts of the same town. The facts surely afford strong corroboration of two propositions: first, that a classification was on the whole accurately made in these cases of persons whose condition in relation to small-pox differed from one another; and, secondly, that this difference of condition was due to vaccination.

270. We have been concerned with the same elements only when investigating the fatality and type of the disease. We have had but to view the same sufferers under different aspects, ascertaining in the first place what was the death-rate in the two classes, and in the next place from what type of disease they suffered. When we came to deal with the attack-rate it was necessary to introduce a new element. Those living in the same houses and who, as far as could be judged, were, from their locality and surroundings, equally liable to be attacked, had to be divided into vaccinated and unvaccinated in order that the attack-rate in these two classes might be ascertained. If strong ground has been given for believing that the discrimination, among the persons attacked, according as they were or were not vaccinated has been successfully accomplished, it is the more likely that the separation of those liable to be attacked into the classes of vaccinated and unvaccinated has also been made with substantial accuracy. At all events the same difficulty has to be encountered by those who maintain that vaccination is without any influence upon small-pox, which we have already indicated when dealing with the question of the fatality amongst the vaccinated and unvaccinated. How does it happen that when a division has, on their hypothesis, been arbitrarily made into two classes, the condition which guided the discrimination not being such as to render the one less subject to attack than the other, it is nevertheless found that with a singular uniformity the rate of attack in the one class is much less than that witnessed in the other? But this is not all; we have to ask, further, how it happens that, whether fatality, attack-rate, or type be regarded, the difference between the two classes is much more marked in the case of children under 10 years of age who are nearer the period of vaccination than it is in the case of persons of more advanced years? To these questions those who deny that there is

any efficacy in vaccination have furnished no satisfactory answers. If, on the other hand, it be conceded that there is virtue in vaccination, and that it renders the vaccinated less liable to be attacked, or to suffer severely from, or to die of, the disease than the unvaccinated, the phenomena are all explained and the difficulty vanishes.

271. We cannot but lay stress on the force of the facts relating to the fatality, the attack-rate, and the type of the disease, in the vaccinated and unvaccinated classes, when considered in combination with one another. So far as can be ascertained there was nothing materially to distinguish the two classes, except that the one contained, with some possible exceptions, unvaccinated persons only, whilst the other consisted certainly for the most part of vaccinated persons, unless it be, as suggested, that the unvaccinated class comprised a larger proportion of weakly persons. We have already expressed our opinion that this suggested distinction is not an adequate explanation of the very different fatality in the two classes if that phenomenon stood alone. It appears to us in no way to account for the difference in the attack-rate and type of the disease which equally distinguish these same classes. Though a stronger constitution may enable a patient better to battle against the disease, and so avoid a fatal result, than a weaker one, we are not aware of any evidence that strength of constitution would determine the type of the disease. We believe that confluent cases are frequently found in those whose constitution is strong and mild cases in those who are not of robust health. Nor again, is there any ground for asserting that if both came equally within the reach of contagion a person of good physique would escape its influence while another less robust would be attacked by the disease. And yet the distinction between the vaccinated and unvaccinated is as marked or even more marked when the attack-rate and type of disease are studied than when the fatality of the disease is in question.

The fatality and severity of type of small-pox amongst vaccinated persons with marks of different quality.

272. In dealing with the comparison between the attack-rate and fatality of the classes of vaccinated and unvaccinated persons, no distinction has hitherto been drawn in respect of the quality or character of the vaccination. Many (though not a large number proportionately) have been included in the vaccinated classes whose arms bore no marks of vaccination. In the case of some of these the operation of vaccination may have been performed without success. If vaccinia did not result from the operation, it could of course have no more effect than if it had never been performed. Amongst those whose bodies showed by the marks they bore that vaccination had undoubtedly been successful, the number of cicatrices varied from one to four and upwards. The cicatrices differed also in size. They have also been distinguished according as they exhibited, or did not exhibit, foveation. The question whether the protection afforded by vaccination differs in proportion as it has been more or less thorough has been made the subject of investigation.

Report on an epidemic of small-pox at Sheffield during 1887–88, pages 212–3.

273. Beginning again with Dr. Barry's report, we find the following facts recorded with reference to the vaccinated persons who were treated in the Borough Hospital in Winter Street, Sheffield, from the commencement of the 1887 epidemic up to 31st March 1888. These numbered in all 825, excluding 39 cases in which the records with respect to the character of the vaccination and the type of disease were incomplete.

95 of these had no visible primary cicatrix, or 1 cicatrix only. Out of this number 13 died, or 13·7 per cent.

259 had 2 primary cicatrices, of whom 24, or 9·3, died.

372 had 3 primary cicatrices, of whom 21, or 5·7, died.

99 had 4 or more primary cicatrices, of whom 2, or 2·0 per cent., died.

Dr. Barry also discriminated the cases with reference to the type of small-pox.

In the class with either no visible primary cicatrix or 1 cicatrix only, the type of small-pox was varioloid in 19, or 20 per cent.; discrete in 47, or 50 per cent.; coherent in 25, or 26 per cent.; and confluent in 4, or 4·2 per cent.

In the class with 2 primary cicatrices, the type was varioloid in 73, or 28 per cent.; discrete in 132, or 51 per cent.; coherent in 50, or 19 per cent.; and confluent in 4, or 1·5 per cent.

In the class with 3 primary cicatrices, the type was varioloid in 149, or 40 per cent.; discrete in 193, or 52 per cent.; coherent in 27, or 7 per cent.; and confluent in 3, or 0·8 per cent.

In the class with 4 or more primary cicatrices, the type was varioloid in 52, or 52 per cent.; discrete in 41, or 41 per cent.; coherent in 5, or 5 per cent.; and confluent in 1, or 1 per cent.

It will be seen that there is a progressive diminution in the fatality, and also in the severity of the attack, in direct ratio to the increase in the number of primary vaccination cicatrices.

274. Dealing separately with those under 10 years of age, we find that:
With no visible primary cicatrices,
or 1 cicatrix only, there were 4 cases:—
2 ,, varioloid.
2 ,, discrete.
With 2 primary cicatrices:—
8 cases, all varioloid.
With 3 primary cicatrices:—
8 cases, 6 varioloid.
2 discrete.
With 4 or more primary cicatrices:—
7 cases, 6 varioloid.
1 discrete.

275. Although the figures with regard to the cases treated in the other Sheffield hospitals during the epidemic are too small, when classified, for the results to be of themselves of much value, they show a general correspondence with the results at the Winter Street Hospital stated in the preceding paragraph.

App. III., pp. 115–6.

276. In relation to the Dewsbury epidemic, Dr. Coupland obtained particulars of the number and character of the marks produced by primary vaccination, in 480 instances, amongst the 627 vaccinated persons who contracted small-pox, but these particulars did not in all instances refer to each of the several points concerned. Thus the *number* of scars is recorded in 461 instances, the character as to *foveation* is recorded in 416, whilst the total *area* of the scars is only recorded in 290 cases.

Of the 461 persons whose marks were recorded there were:—
With 4 or more marks 42, of whom 1 died, or 2·3 per cent.
,, 3 marks 210, of whom none died.
,, 2 ,, 175, ,, 10 died, or 5·7 per cent.
,, 1 ,, 34, ,, none died.

It may be of importance to note that as regards age, the fatal case amongst those having four or more marks was in the age class 30–40, whilst the 10 fatal cases with two marks were distributed thus:—

5 to 10 years	1
15 ,, 20 ,,	1
20 ,, 30 ,,	3
30 ,, 40 ,,	3
50 ,, 60 ,,	2

277. Dr. Coupland remarks that there is abundant scope for variation in the degree of foveation in vaccination marks. For the purpose of analysis he groups the cases into series according as all the marks are (*a*) plain and well foveated; (*b*) some foveated, others not, or in which the foveation and outline of the scar are indistinct; (*c*) those marks which present no foveation, but either a smooth surface, and perhaps a faint appearance, or else composed of more or less radiate cicatricial tissue, causing a mark of great prominence and irregular outline.

278. Of the 416 cases, of which the records are given, he places 294 in the first group, 32 in the second, and 90 in the third, remarking, however, that the classification is an arbitrary one, and that too much stress cannot be laid on the conclusions drawn from an analysis based upon it. The result shown is as follows:—
Having foveate marks 294, of whom 4 died, or 1·3 per cent.
Having partly or faintly foveate marks 32, of whom none died.
Having smooth, faint, or thick scars 90, of whom 2 died, or 2·2 per cent.

279. In dealing with the area of scars, Dr. Coupland adopted the classification of the vaccination scars according to their areas, employed in the statistical tables of the Metropolitan Asylums Board. The groups he formed were three in number, viz., class A^1 having marks the total area of which measured $\frac{1}{2}$ or more of a square inch; class A^2 in which the total area of marks was $\frac{1}{3}$ but less than $\frac{1}{2}$ of a square inch; and class A^3 in which the total area was less than $\frac{1}{3}$ of a square inch. The area was obtained in 290 cases.
246 fall into Class A^1 with 3 deaths, fatality 1·2 per cent.
27 ,, ,, A^2 ,, 1 ,, ,, 3·7 ,,
17 ,, ,, A^3 ,, 1 ,, ,, 5·8 ,,

280. From Dr. Coupland's report on the Leicester epidemic we obtain the following particulars:— App. VI., page 46.

In the vaccinated class, which consisted of 198 cases, the number of primary vaccination cicatrices was recorded in 182 of them, viz., 6 with 1 cicatrix, 42 with 2 cicatrices, 64 with 3 cicatrices, and 70 with 4 or more cicatrices.

The following tables show the distribution of the types of small-pox in relation to the number of cicatrices:—

Having one primary cicatrix:—

Confluent	1	16·6 per cent.
Coherent	1	16·6 "
Discrete	1	16·6 "
Mild	3	50·0 "

Grouping the severer and milder forms we have:—

Confluent and coherent, 33·2 per cent.
Discrete and mild, 66·6 per cent.

Having two primary cicatrices:—

Confluent	8	19·0 per cent.
Coherent	3	7·0 "
Discrete	11	26·2 "
Mild	20	47·6 "

Grouping the severer and milder forms together we have:—

Confluent and coherent, 26·0 per cent.
Discrete and mild, 73·8 per cent.

Having three primary cicatrices:—

Confluent	5	7·8 per cent.
Coherent	10	15·6 "
Discrete	19	29·7 "
Mild	30	46·9 "

Grouping the severer and milder cases we have:—

Confluent and coherent, 23·4 per cent.
Discrete and mild, 76·6 per cent.

All the above tables relate to persons over ten years of age. There was no case of a person under ten years of age within either of the classes of which the tables are composed.

Having four or more primary cicatrices:—

Type of Small-pox.	Under 10 Years.	Over 10 Years.	Proportion at all Ages.
Confluent	—	2	2·8 per cent.
Coherent	—	6	8·5 "
Discrete	—	16	22·8 "
Mild	2	44	65·7 "

Grouping them again according to the severer and milder forms we have:—

Confluent and coherent, 11·3 per cent.
Discrete and mild, 88·5 per cent.

281. It is interesting to compare these results with a similar analysis of the *unvaccinated* persons at Leicester who were attacked by small-pox:—

Type of Small-pox.	Under 10 Years.	Over 10 Years.	At All Ages.
Confluent and malignant	54 or 51·9 per cent.	25 or 50·0 per cent.	79 or 51·3 per cent.
Coherent	23 " 22·1 "	13 " 26·0 "	36 " 23·3 "
Discrete	19 " 18·2 "	8 " 16·0 "	27 " 17·5 "
Mild	8 " 7·7 "	4 " 8·0 "	12 " 7·7 "

282. Dr. Luff's report on the London outbreak furnishes the following information. He obtained the number of vaccination scars, and also the condition as to foveation in 1,580 cases. He ascertained the area of the vaccination scars in 1,340 cases. The App. IV., pp. 7–9 an 17–19.

following table shows the relation between the number of scars and the type of the disease :—

—	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.
	One Scar.		Two Scars.		Three Scars.		Four Scars.	
Under 10 years - -	10	0	13	0	25	2	35	0
Over 10 years - -	249	35	310	27	346	28	486	14

The result may be summarised thus :—

With 1 scar there were 7·4 cases of discrete to 1 case of severe or confluent.
,, 2 scars ,, 11·9 cases of discrete to 1 case of severe or confluent.
,, 3 ,, ,, 12·3 cases of discrete to 1 of severe or confluent.
,, 4 ,, ,, 37·2 cases of discrete to 1 of severe or confluent.

It will be noticed that the only confluent cases under the age of 10 were in the class with three scars, and that the cases of discrete in the three-scar class under that age were in a proportion of 12·5 to one severe or confluent, or almost exactly the same proportion as in the same class at all ages.

Turning to the fatality we find that there were :—

With 1 scar, 294, of whom 8 died, or 2·7 per cent.
,, 2 scars, 350 ,, 12 ,, 3·4 ,,
,, 3 ,, 401 ,, 5 ,, 1·2 ,,
,, 4 ,, 535 ,, 6 ,, 1·1 ,,

283. Discriminating now between the scars, according as they were foveated or unfoveated, we obtain the results which appear in the following table :—

Number of Scars.	Foveated.		Unfoveated.	
	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.
One - - - -	147	15	112	20
Two - - - -	222	7	101	20
Three - - - -	261	17	110	13
Four - - - -	341	8	180	6
	971	47	503	59

An examination of the total numbers shows that in the foveated class 95·3 cases were discrete, while 4·6 were severe or confluent, and that in the unfoveated class 89·5 were discrete, and 10·4 severe or confluent.

284. If the fatality in the two classes be examined we find the following results :—

Foveated.

One scar, 162 cases, with 5 deaths, or 3·0 per cent.
Two scars, 229 ,, 3 ,, 1·3 ,,
Three ,, 278 ,, 2 ,, 0·7 ,,
Four ,, 349 ,, 3 ,, 0·8 ,,

The total, amounting to 1,018 cases with 13 deaths, shows a death-rate of 1·2.

Unfoveated.

One scar, 132 cases, with 3 deaths, or 2·2 per cent.
Two scars, 121 ,, 9 ,, 7·4 ,,
Three ,, 123 ,, 3 ,, 2·4 ,,
Four ,, 186 ,, 3 ,, 1·6 ,,

The total number in this class is 562, with 18 deaths, or a death-rate of 3·2 per cent.

285. With reference to the area of scars, Dr. Luff gives the following information. He divides the scars in respect to their area according as they are under ·25 of the square inch, or from ·25 to ·5 of the square inch, or over ·5 of the square inch.

An analysis of the cases, viewed in relation to their area, gives the following results:—

	Per-centage of Severe and Confluent Attacks.
Area under ·25 - - - - - -	12·6
Area from ·25 to ·5 - - - - - -	4·6
Area over ·5 - - - - - -	3·9

Or, to put the case in another way:—

Area under ·25 there were 6·9 discrete cases to 1 confluent.
Area for ·25 to ·5 „ 20·3 „ 1 „
Area over ·5 „ 24·0 „ 1 „

286. Examining the fatality in the classes thus divided according to the area of the scars, we have the following results:—

Area under ·25 there were 253 cases, with 6 deaths, or 2·3 per cent.
Area from ·25 to ·5 „ 385 „ 7 „ 1·8 „
Area over ·5 „ 702 „ 10 „ 1·4 „

287. In his report on the Warrington epidemic Dr. Savill divides the vaccinated persons, who bore marks of vaccination, into two classes, which he terms "well "vaccinated" and "indifferently vaccinated." In the well vaccinated class he includes "all persons whose primary vaccination scars are fairly well marked in their foveation "(or pitting), and of an aggregate area (irrespective of number) of half a square inch "and upwards." In the indifferently vaccinated class he includes "(*a*) persons whose "primary scars, though foveate, are in the aggregate (irrespective of number) under "half a square inch area, and (*b*) other persons whose primary marks, irrespective of "number of size, are entirely non-foveate, and therefore generally indistinct (plain, or "flat, or faint)." App. V., pp. 22 and 28.

The well vaccinated class consisted of 350. The type of disease was distributed as follows:—

Of the 350 well vaccinated cases—

58·6 per cent. were mild.
23·7 „ „ discrete.
17·8 „ „ confluent.
2·9 per cent. died.

Of the 208 indifferently vaccinated cases—

50·0 per cent. were mild.
24·0 „ „ discrete.
26·0 „ „ confluent.
8·2 per cent. died.

288. Dr. Gayton, in his analysis of the cases of the Homerton Hospital already referred to, furnishes the following particulars:— 2, App. 243–4.

Of 529 persons with 1 good mark, 22 died, or 4·1 per cent.
„ 649 „ „ 2 „ marks, 22 „ 3·3 „
„ 518 „ „ 3 „ „ 12 „ 2·3 „
„ 389 „ „ 4 or more good marks, 6 died, or 1·5 per cent.

289. The following table gives the results derived from Mr. Sweeting's observations at the Fulham Hospital, divided according to the age periods 0 to 10, and over 10 years of age:— Q. 3717.

—	One Mark.			Two Marks.			Three Marks.			Four and over Four Marks.		
	Cases.	Deaths.	Death Rate.	Cases.	Deaths.	Death Rate.	Cases.	Deaths.	Death Rate.	Cases.	Deaths.	Death Rate.
0–10 - - -	21	1	4·76	29	1	3·45	37	0	0	53	0	0
Over 10 years of age -	384	41	10·68	509	46	9·04	459	37	8·06	396	19	4·80
At all ages - -	405	42	10·37	538	47	8·73	496	37	7·45	449	19	4·23

Q. 3722. 290. With regard to the area of the marks, Mr. Sweeting gives the following information:—

—	More than ½ square inch total Area.			Less than ½ square inch total Area.		
	Cases.	Deaths.	Death Rate.	Cases.	Deaths.	Death Rate.
0–10	0	0	—	11	0	0
Over 10 years of age	60	3	5 per cent.	240	40	16·6 per cent.

1, App. 116. 291. Dr. Thorne Thorne handed us a table founded (*a*) on information given in the 36th volume of the Medico-Chirurgical Society's Transactions by Mr. Marson, as the result of his observations made during the years 1836 to 1851 on 3,094 cases of post-vaccinal small-pox, and (*b*) on data derived from Mr. Marson's evidence before the Vaccination Committee of 1871, based on a further experience of 10,661 such cases, and covering the years 1852 to 1867.

Cases of Small-pox classified according to the Vaccination Marks borne by each Patient respectively.	Per-centage of Deaths in each Class respectively; Uncorrected.*		Per-centage of Deaths in each Class respectively; Corrected.*	
	1836–51.	1852–67.	1836–51.	1852–67.
1. Stated to have been vaccinated, but having no cicatrix	25·5	40·3	21·7	39·4
2. Having one vaccine cicatrix	9·2	14·8	7·6	13·8
3. Having two vaccine cicatrices	6·0	8·7	4·3	7·7
4. Having three vaccine cicatrices	3·6	3·7	1·8	3·0
5. Having four or more vaccine cicatrices	1·1	1·9	0·7	0·9
Unvaccinated	37·5	35·7	35·5	34·9

* The terms *uncorrected* and *corrected* are used to signify the inclusion or exclusion of those fatal cases of small-pox in which the patient suffered from some other disease superadded to the small-pox.

3094 vac 10,671

292. Reviewing now the evidence on this subject, we observe that at Sheffield there was a distinct diminution in both the fatality and the severity of the disease in proportion to the number of the marks. At Leicester the proportion of severe cases were less as the marks increased in number. The same is true of the experience of the fatality in London hospitals supplied by Dr. Gayton's and Mr. Sweeting's analysis; and the table founded on Mr. Marson's cases affords evidence to the same effect.

Dr. Coupland's experience at Dewsbury differed somewhat. Whilst none of those with one mark died, the deaths were 5·7 in the class with two marks; and whilst none of those with three marks died, the fatality in the four-mark class was 2·3 per cent. It is to be observed, however, that there were only 34 with one mark. The two-mark class was more than four times as numerous, viz., 175. In the three-mark class there were 210, and the fatality in the four-mark class is founded on one death only, the total number of that class being 42.

On examining Dr. Luff's returns with regard to the London epidemic, it will be seen that the fatality in the class with two scars is slightly in excess of the fatality in the class with one scar, being 3·4 as against 2·7. There is, however, a very marked contrast between these two classes and those with three and four scars, the per-centages in which are 1·2 and 1·1 respectively.

293. Taken together, the number of cases, classified according to the marks found on the patients, is very considerable; it exceeds 20,000. Apart from Mr. Marson's cases the number is 6,839. Dealing with this number, they being all cases in which the observations were made in very recent years, and dividing into classes according to the number of marks, we obtain the following result:—

1 mark,	1,357	cases, with	85	deaths, or	6·2	per cent.
2 marks,	1,971	„	115	„	5·8	„
3 „	1,997	„	75	„	3·7	„
4 „	1,514	„	34	„	2·2	„

Q. 1697–1706. Dr. Gayton, in his evidence, stated that, in the analyses which he gave of the cases at the Homerton hospital, when he found one good mark and some imperfect marks, he ignored the imperfect marks and only recorded the good one. As the basis of his calculations was not precisely the same as that adopted in the other cases, it may be well to see how the figures would stand if Dr. Gayton's cases be eliminated. We should then have 4,754 cases, distributed as follows:—

1 mark,	828 cases,	with	63 deaths,	or	7·6	per cent.
2 marks,	1,322	„	93	„	7·0	„
3 „	1,479	„	63	„	4·2	„
4 „	1,125	„	28	„	2·4	„

We think it is of importance to ascertain the effect of combining in this way the information obtained from different observers. The greater the number of cases in which the comparison can be made, the less opportunity is there for the undue influence of any accidental circumstance, and consequently the higher is the value of the result.

There is no doubt some room for error. It may be that the number of scars was by accident incorrectly recorded, or even that some which had existed had ceased to be apparent. But it is not probable that either of these causes of error can have much influenced the result. Moreover, if there be no connexion between the degree of protection and the number of vaccination marks, there is no reason why chance errors of classification should have led to the appearance of a higher fatality in those with fewer vaccination marks rather than to the opposite result.

294. Upon the whole, then, the evidence appears to point to the conclusion that the greater the number of marks the greater is the protection in relation to small-pox enjoyed by the vaccinated person. This further indication also seems to be afforded, that whilst the distinction in this respect between those with one and those with two marks is not very great, there is a very marked contrast between those with four or even with three marks as compared with those with either one or two.

295. The view which attributes a different protective effect to vaccination according to the number of marks receives confirmation from an examination of the type of the disease from which those with one, two, three, or four marks suffered. The particulars given in the Sheffield, Leicester, and London reports afford an indication that the disease varies in its severity inversely as the number of the vaccination marks.

296. There does not appear to be evidence of the same importance to show that foveation of the vaccination marks indicates a condition of better protection in the vaccinated person, though the facts we have detailed may be said, on the whole, to tend in that direction. The only reports which deal directly with this point are those relating to Dewsbury and London. In the former case the numbers are small and the result shown is by no means conclusive. In the latter, both as regards fatality and mildness of the disease, the foveated class show a distinct advantage over the unfoveated.

At Warrington, Dr. Savill based his discrimination into two classes of well and indifferently vaccinated, upon a consideration of the condition of the persons as regards area and foveation combined. There was a very marked distinction in the fatality of the two classes and a distinction, though less marked, in the type of disease from which they suffered.

297. As regards the area of the vaccination marks, though the classification adopted was not quite the same, Dr. Coupland in Dewsbury, Dr. Luff in London, and Mr. Sweeting at the Fulham Hospital, all found some evidence of superior protection according as the area of the vaccination marks was larger. This will be seen by a reference to the statistics quoted above.

298. The investigation of this matter and of the relation between foveation and the protective power of vaccination has, however, been of a range so much more limited than the inquiry into the connexion between the number of marks and its protective power that the results furnish material of less value, and any conclusions drawn from them must necessarily be of less weight.

As to re-vaccination.

299. The subject of re-vaccination, to which we have already alluded, is obviously one of great importance. If vaccination exercises a protective influence which diminishes in its effect after the lapse of some years, it is of moment to ascertain whether that influence can be restored by a repetition of the vaccine operation. Moreover, if it should be found that re-vaccinated persons are more favourably situated with reference to an attack of small-pox than unvaccinated persons or than persons vaccinated only in infancy, this would obviously have a direct bearing on the disputed question whether vaccination has a protective influence.

300. Unfortunately it is not possible to obtain any statistics showing the amount of re-vaccination in this country generally. It is certain that it varies greatly in different towns, and the amount is probably not anywhere large, in proportion to the number of the population who have passed the age of childhood. The proportion of re-vaccinated persons to the population almost certainly increases in any town immediately after it has been visited by an epidemic of small-pox. A panic then arises which leads many people to resort to vaccination.

301. In the towns where the epidemic outbreaks of small-pox were investigated, an endeavour was made, amongst other particulars, to ascertain the facts with regard to re-vaccination.

Q. 1904, 2035–7.

In the borough of Sheffield, during the epidemic of 1887 to 1888, Dr. Barry appealed through the public press and to medical men practising in Sheffield for information as to any cases in which persons had been attacked by small-pox after re-vaccination. It was reported to him from all sources that 352 persons had been so attacked from the beginning of the epidemic to March 31, 1888. Dr. Barry personally inquired into all these cases. Twenty-three of them had removed and could not be traced. Of the 329 who were inspected, it was ascertained that some had not been attacked by small-pox, that others had never been vaccinated at all, or had been vaccinated or re-vaccinated during the incubative stage of small-pox, whilst some had been re-vaccinated during recovery from small-pox.

Forty-eight, or 4·6 per cent., had been re-vaccinated unsuccessfully, whilst 26 only had been re-vaccinated successfully prior to the incidence of small-pox. In addition to those inspected, one person, who had been successfully re-vaccinated, was fatally attacked by small-pox in 1887. The number of persons found to have been attacked by small-pox after successful re-vaccination was thus 27 in all.

Of the 27 cases of small-pox after re-vaccination at Sheffield, one ended fatally. He had been re-vaccinated in 1869. In 19 of the 27 re-vaccinated persons the disease was of an extremely mild character; in two there was a copious eruption, but no pitting ensued; in three others the attack was severe, and was followed in two of them by slight pitting, and in the third by bad pitting; in two others it was doubtful whether they were genuine cases of small-pox. The fatal case has just been referred to.

302. In speaking of re-vaccination it is necessary to distinguish between cases in which the operation has been performed without result and cases of successful re-vaccination. It is only when the vaccine virus has induced vaccinia that a person can properly be called re-vaccinated. The term is, however, often applied where the attempt to re-vaccinate has failed. In that case the subject of the operation has acquired no more protection by the process than if re-vaccination had never been attempted. No doubt the want of success shows, if the operation has been thoroughly performed, that the person is at the time insusceptible to the virus, and, it may be, to the virus of small-pox also. But this condition of insusceptibility is not necessarily permanent, and it is impossible to predicate how long it may last. Moreover, experience shows that where re-vaccination has led to no result, a repetition of the process after the lapse of a few days only may produce the normal features of successful re-vaccination. A single unsuccessful attempt at re-vaccination cannot therefore be regarded as an indication of insusceptibility unless of the most transient nature. Where re-vaccination is not successful, this may be due on the one hand to insusceptibility produced by the previous vaccination, or, on the other hand, to impotency of the operation caused by the inperfection of the lymph used or by want of skill on the part of the operator. Where re-vaccination, unsuccessful at the first attempt, is successful when the operation is repeated after a short interval, there is strong reason for thinking that the want of success was due to the latter and not to the former cause.

If a re-vaccination is unsuccessful it ought not from that fact to be taken for granted that immunity is certain, but the operation should be repeated once or even twice, as in the case of failure of primary vaccination in infants.

303. In the census, to which we have already alluded, taken at the time of the epidemic in Sheffield, the number of persons re-vaccinated was enumerated. They amounted to 64,431. Estimating the attack-rate amongst this class, of whom 27 were attacked by small-pox, we find it to be 0·04 per cent. Q. 2037–9.

The attack-rate of vaccinated persons over the age of 10 years enumerated in the Sheffield census was 1·9, and of unvaccinated persons of a similar age was 9·4.

The fatality per cent. of vaccinated persons attacked above the age of 10 years was 5·1, of unvaccinated persons 54·2. The one death among the 27 re-vaccinated gives a fatality of 3·7.

304. It is important in connexion with the subject we are considering to state the result of the inquiries into the cases of second attacks of small-pox which were made in the course of the investigations of the circumstances relating to the local small-pox epidemics at Sheffield and elsewhere. We have already pointed out that an attack of small-pox, though in general protecting against a subsequent attack, does not confer an absolute immunity. The view that it did practically confer such an immunity was very prevalent at the beginning of the present century. It was not, however, universally held. Jenner gives the details of a case, as one among many others, showing that a second attack may occur, though he admits that it is so rare as to be regarded as a phenomenon. Other writers, such as Monro (*Observations on the different kinds of Small-Pox*, 1818), Thomson (*An Account of the Varioloid Epidemic in Edinburgh*, 1820), and Cross (*On Variolous Epidemics*, 1820), describe it as not uncommon. Indeed the evidence that second attacks do occur is beyond dispute. With regard to the frequency of such attacks, the only exact evidence available is that relating to the Sheffield epidemic, furnished by Dr. Barry, to which we are about to refer.

305. In the Sheffield census, 18,292 persons were reported as having suffered from small-pox prior to 1887. Of these, 23 were attacked during the epidemic of 1887–88. It will be seen, therefore, that the attack-rate was 0·13 per cent. Five of the persons attacked died. Both the attack-rate and the fatality were higher in the class which had previously suffered from small-pox than in the re-vaccinated class. Q. 2040.

With respect to the fatality of a second attack of small-pox, it may be noted that in many of the individual cases recorded, as in the special case quoted by Jenner, the second attack was fatal. Thomson, in the work already referred to, speaks of the fatality of attacks of small-pox after small-pox as being comparatively greater than that of small-pox after vaccination. It will be observed that in Sheffield the fatality, shown by the figures, was very high, being 5 out of 23, or 21·7 per cent. In Dewsbury, Warrington, and Leicester, however, there were 12 cases of a second attack of small-pox without a single fatal result. If these be added to the Sheffield figures it gives 35 cases with 5 deaths, or a per-centage of 14·2.

App. III., p. 125; App. V., pp. 48 and 28; App. VI., p. 22.

It has been pointed out that the immunity in relation to small-pox acquired by a previous attack of that disease thus differs from that derived from cow-pox in that while the incidence or attack-rate in the former case is much lower than in the latter, the fatality is much higher, and it has been suggested that this want of correspondence raises a doubt as to whether in the latter case there is a real immunity. Such a purely theoretic objection, even if valid, could not have great weight. In our want of knowledge as to the exact chain of events within the body which bring about immunity, differences, such as the above, in certain characteristics of the immunity are negligable in comparison with the facts indicating that the immunity does exist. But it is not a valid objection, since the figures relating to small-pox after small-pox, as compared with those of small-pox after cow-pox, are far too small to allow of any confidence in a comparison between the two. Again, the figures are so small as to justify an examination of the individual cases. Now, in two of the five deaths recorded by Dr. Barry, the cause of death was, so to speak, accidental; the patients in delirium exposed themselves to cold, and presumably would not otherwise have died. In a third case death was from apoplexy, which is not a natural part of the small-pox disease. Of course, where large numbers are dealt with, all such accidental circumstances may be neglected; their effects are neutralised by the numbers; but in such small numbers they may justly be taken into account. If this is done, the five deaths really due to small-pox are reduced to two, and the fatality becomes quite low. It may be added that only one of these five deaths is a clear example of death by a second attack of

Report on an epidemic of small-pox at Sheffield during 1887–88, pp. 46, 87, and 157.

small-pox uninfluenced by other circumstances, the individual having certainly had small-pox, and never having been vaccinated, for the other death was a case in which the evidence of the first attack was inadequate, and which had been vaccinated.

It would appear, then, that such statistics as we possess do not corroborate the impression which is apt to be made by the scattered records of the individual cases of second attacks, owing to so many of these having a fatal issue. Indeed, many at least of these fatal second attacks may perhaps be regarded as instances of exceptional susceptibility.

On the whole, we think the evidence tends to show that there is no such want of analogy in the immunity secured by a previous attack of small-pox or by cow-pox as to constitute a valid objection to the reality of the immunity conferred by cow-pox.

App. III. pp. 119–20.

306. Turning now to Dewsbury, we obtain the following information from Dr. Coupland's report:—

There were 14 individuals attacked by small-pox during the epidemic who were said to have been re-vaccinated. In four, at least, of the 14 cases the re-vaccination appears to have been unsuccessful. We have already pointed out that these cannot be regarded as cases of re-vaccination. In five of the other cases there was no definite evidence shown of re-vaccination; in another case the re-vaccination was not performed until one day after the appearance of the rash of small-pox; whilst in three other cases the re-vaccination was only from twelve to eight days prior to the attack, when, therefore, the small-pox virus was already at work.

In the remaining case, where the vaccination had preceded the attack by three weeks, the disease was of a mild character. There were only two confluent cases (one of them being a fatal case) amongst those said to have been re-vaccinated, in neither of which was there definite evidence re-vaccination having been successfully performed.

App. VI., 60–2.

307. In Leicester, during the epidemic, in a group of 133 houses with 842 inmates, of whom 141 were attacked, there were 84 re-vaccinated persons, of whom one was attacked by small-pox. In another group of 60 houses with 392 inmates, of whom 179 were attacked, there were 31 re-vaccinated persons, of whom five were attacked.

We notice that in the first group of houses the attack-rate in the vaccinated class was 14·6 per cent.; amongst the re-vaccinated it was 1·1.

Dealing in a similar way with the second group of houses, which were more intensely infected than the other group, and where the attack-rate was consequently higher, we find that out of 31 re-vaccinated persons five were attacked, or a rate of 16·1 per cent., whilst amongst the vaccinated it was 35·3, and amongst the unvaccinated 59·6.

App. IV., pp. 6 and 17.

308. In London Dr. Luff reported the number of attacks of re-vaccinated persons to have been 108, with four deaths, showing a fatality of 3·7. The fatality shown amongst vaccinated persons above the age of 10 in the same epidemic was 4·2. The fatality amongst the unvaccinated of a similar age was 20·9.

The character of the disease in the re-vaccinated class was reported to be mild in 101 cases, and severe in seven.

App. V., pp. 27 and 43.

309. At Warrington in the invaded houses there were 64 re-vaccinated persons. Of these 8 or 12·5 were attacked. The per-centage of unvaccinated persons attacked in the same houses was 56·0 per cent., and of vaccinated persons over 10 years of age 29·9 per cent. There were in those houses 41 persons who had previously had small-pox. Of these five were attacked, or 12·1 per cent. There was no death either in the re-vaccinated class or amongst those who had previously suffered from small-pox.

310. The reports from which we have just quoted throw light in other ways upon the effect of re-vaccination.

Q. 2027.

The average strength of the troops stationed at Sheffield during 1887–8 was about 830 of all ranks. The whole of these were, or should, in accordance with the Army regulations, have been at one time re-vaccinated or vaccinated in the exceptional cases where they had not been previously vaccinated. Twelve men, or 1·4 per cent. of the total strength, contracted small-pox, and of these one died. Not one of the soldiers who contracted small-pox had been *successfully* re-vaccinated. During the period of the epidemic the men mingled freely with their friends in the town, and although the neighbourhood of the barracks was one of the first localities invaded by the disease, no successfully re-vaccinated soldier quartered in Sheffield suffered from small-pox.

Q. 2027–8. 311. Turning now to the incidence of the disease upon the police force of the borough of Sheffield, it apppears that there were 372 men of all ranks. Of these 10 constables contracted small-pox. These men, though vaccinated in infancy, had not been re-vaccinated. On 10th February 1888 the Chief Constable issued an order directing the re-vaccination of every man in the force. After that date, down to the time when Dr. Barry made his report, no constable contracted small-pox. It should be observed, however, that the epidemic ceased in the following August, and that rather more than 70 per cent. of the cases occurred before the 25th February. The police, in carrying out their ordinary duties, were of necessity frequently brought into close relation with infected persons and things.

Q. 2029. 312. There were at the time of the epidemic 290 men and boys employed on the permanent staff of the Sheffield Post Office. The Post Office regulations require re-vaccination before engagement. Dr. Barry truly points out that the duties of letter carriers, telegraph boys, &c. continually bring them into personal contact with infected persons and things, yet no member of the permanent staff of the Post Office contracted small-pox.

313. The facts relating to the attendants in small-pox hospitals deserve close attention. Many of them spend their time in what may be termed a hot bed of contagion. They are in constant personal contact with persons suffering from the disease. There are others who, though not themselves necessarily in actual contact with the sick, are in constant communication with attendants on small-pox cases.

Q. 2029–30; 19,905–7; 28,799–804. 314. During the year ending 31st March 1888 four hospitals were used in Sheffield for the treatment of acute cases of small-pox. The bed accommodation in these four hospitals was 315, and 1,798 patients were treated in them in the course of that year. Some of these patients when convalescent were transferred to a fifth hospital, with 60 beds, which was used during part of the year for convalescent small-pox patients only. In these hospitals the total number of attendants in personal contact with the sick was 140. There were 21 other persons in constant communication with these attendants. Of these 161 persons 18 had suffered from small-pox prior to the epidemic, and none of the 18 contracted the disease again. One other had been vaccinated in infancy, and was re-vaccinated unsuccessfully on entering the hospital for convalescents, but successfully some days later; 14 days after entering the hospital she had a very mild attack of small-pox, which did not necessitate her going to bed. Sixty-two others had been vaccinated in infancy only, of whom six contracted small-pox, and one died. Of the remaining 80, all of whom had been successfully re-vaccinated, not one contracted small-pox.

App. V., p. 44. 315. At Warrington a force of 300 regular troops and 200 militiamen resided in the barracks in the N.E. corner of the town. In addition to these, 80 women and about 213 children resided in barracks. The only case of small-pox among the inhabitants of the barracks, numbering some 800 persons, occurred in the case of a militiaman. Although all recruits to the regular troops are re-vaccinated on joining, Dr. Savill was informed that this was not the rule with militia recruits, who are not re-vaccinated unless their marks are imperfect. The practice is the same as regards the women and children residing in barracks. At the time of the epidemic an inspection was made by the surgeon in charge, and re-vaccination performed wherever the original marks were reported not good.

316. No cases of small-pox were reported as occurring either in the police force or the postal service, in both of which re-vaccination was extensively practised either before or during the panic.

App. V., pp. 44 and 11. 317. Only two members of the staff of the Aikin Street Hospital, where small-pox patients were treated, were attacked by small-pox. They were the only two members of the staff who were not re-vaccinated at the commencement of the outbreak. Dr. Savill adds in a note, that one of these subsequently stated she was re-vaccinated a few days before the eruption, but if, as would appear, this was after the small-pox virus had begun its work the circumstance is not material.

App. V., pp. 20, 44, and 75. 318. The largest number of cases of small-pox in any place of employment in the town arose at the Dallam and Bewsey Ironworks, which were situate near the temporary small pox hospital. The disease first attacked persons employed at these works during the last week in August 1892. Dr. Savill states that there was at first some apathy and opposition on the part of the workmen to the practice of vaccination; they could not be persuaded of the necessity. However, the sick fund committee of the works, *i.e.*, a committee of the men's representatives, acting on the suggestion of the manager and the medical officer of the works, passed the following resolution on November 12, 1892: "That any member who remains unrevaccinated after Monday, November "21st, 1892, shall not be entitled to any sick benefit should he be afflicted with "small-pox." The expense of re-vaccination was borne by the sick fund.

The medical officer states that, as a consequence of this, between 1,400 and 1,500 hands were re-vaccinated during the last two weeks of November, and a good many others were vaccinated by their private doctors.

After the second week in December, when the vaccination would have become effectual, there were down to the end of the epidemic only 12 cases of small-pox. Dr. Savill states that he was informed by the Medical Officer of Health that these were in the case of men who had either refused re-vaccination or joined subsequently.

App. VI., page 33. 319. At Leicester, at the end of the year 1892, the staff at the hospital consisted of 28 persons. Fourteen of these had either previously had small-pox or had been re-vaccinated before the outbreak. Eight others were vaccinated at the time of the outbreak. The remaining six, although they had not previously been re-vaccinated, refused to submit to the operation. During the outbreak there was an addition of 12 to the staff dealing with small-pox cases. These were all re-vaccinated, and none of them contracted small-pox. Out of the 28, six were attacked by the disease, of whom one died. Five of the persons thus attacked, including the one fatal case,[*] were amongst the six persons who had refused to be re-vaccinated, though in the case of one of the five consent was afterwards given to the operation, but it was only performed on the day that she showed premonitory symptoms of small-pox. The sixth case, a mild one, was that of a nurse who had been re-vaccinated 10 years before.

Q. 1719-26, 1795-6. 320. Dr. Gayton gives the following facts as regards small-pox among the hospital staff at the Homerton Small-pox Hospital. From 1st February, 1871, the date when the hospital opened for the reception of patients, to the end of 1877, 366 persons had been employed in the hospital. All of these were re-vaccinated on commencing duty, with the exception of an assistant nurse, who was not brought under Dr. Gayton's notice for some reason until after she had been in the wards. This woman in a fortnight was down with small-pox, and passed through a severe attack, but recovered. Dr. Gayton was unable to give the exact number employed in the years subsequent to 1877, but he thought it might be fairly estimated that an equal number were engaged in the work. There was only one person attacked among these, she had not been re-vaccinated. A third case occurred, in which a nurse engaged in the hospital was attacked. She was sent into a ward on 27th February 1880 after being re-vaccinated. On 3rd March the operation, being evidently a failure, was repeated. On 7th March, however, she presented symptoms of small-pox.

In the small-pox ship-hospitals of the Asylums Board during the 12 years 1884–95, among the attendants (doctors, nurses, and servants), varying in numbers from below 50 during the year to a little over 300, cases of small-pox have occurred in three years only, in 1884, in 1892, and in 1893; in all the other years there were no cases at all. In 1884, with 283 attendants employed, there were four cases; in 1892, two cases among 138 attendants; in 1893, six cases among 320 attendants. It is a striking fact that in all these years there should have been so few attacks of the disease amongst so many persons who were in a remarkable way exposed to contagion, for the exposure to contagion in a ship-hospital is very great. It is to be observed that in one of these cases the disease appeared within three days of her entering the hospital; in another nine days, in four others ten days, and in four others twelve to fifteen days after they joined the staff. None of the recorded cases appear to have been re-vaccinated successfully prior to the period of incubation of the small-pox, though the operation was in all cases attempted shortly after joining.

Q. 3733, 3775-92, 3799. 321. Mr. Sweeting gives the following statistics on the same point with reference to the Western Hospital, formerly the Fulham Hospital:—The total staff, during the time the hospital has been in use, is stated by him to have been 362, of whom one half, roughly speaking, were habitually employed in the wards. Of the 362, 48 had had small-pox before they came into the hospital. Of 314 persons who had never had small-pox, seven contracted the disease. Two of these seven had not been re-vaccinated on entering the hospital, owing to some oversight. Two were unsuccessfully re-vaccinated, one of these being a case of second small-pox; another was not re-vaccinated early enough, as the operation was not performed until the fifth day; and in the other two cases there is no record of any result. These occurred in his predecessor's time. The total staff employed in ambulance duty was 42. Of this number only one took the small-pox. He was not re-vaccinated, his arrival not having been reported. He contracted the disease 13 days after he arrived on duty.

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[*] *The person in whose case the disease was fatal was said to be of intemperate habits.*

322. Mr. Marson, surgeon to the Highgate Small-pox Hospital, giving evidence in 1871 before the Select Committee, stated that during the preceding 35 years no nurse or servant at the hospital had been attacked with small-pox. Since then, up to the present time, one case only, that of a gardener, has occurred, so that there is now a record of nearly 60 years with one case only. Of the 137 nurses and attendants who have been taken on since May 1883, 30 had had small-pox previous to their entering the service. (Some of these were patients in the hospital, engaged as nurses or ward maids after their recovery.) All the others were re-vaccinated upon entering the service, with the exception of the one case, the gardener, who took the disease.

323. Some stress has been laid upon a statement made by Mr. Porter, who was for a short time medical officer at the South Dublin Union Hospital in 1871, that "the "experiment of not re-vaccinating the nurses was tried at the small-pox hospital at "the South Dublin Union in 1871–2; 29 out of the 36 attendants had not been "re-vaccinated, and these all escaped small-pox as well as the other 7." It appears that Mr. Porter's employment at the hospital lasted only about a week, and although he states that he made some inquiry or examination as to whether these 29 persons had previously suffered from small-pox, he admits that he knew nothing on this point except "in a general way." He "did not make a very minute inquiry." It had been usual, he thinks, before he went to the hospital to re-vaccinate the nurses, though he does not think it was compulsory. He could give no information as to why these nurses, who were at the hospital before he came there, had not been re-vaccinated. He seems to have made no inquiry on the point. The statement was originally made in a paper read by Mr. Porter before a Medical Society in the year 1872. There was no reference in this paper to the question whether the nurses not re-vaccinated had previously suffered from small-pox. Upon the whole, then, it cannot be regarded as certain that none of the 29 nurses referred to had suffered from small-pox, even if it is to be taken as a fact that they were none of them re-vaccinated.

Q. 22,190.
22,207–29,
22,239–320.

324. It is not easy to understand why so much stress has been laid on the fact, if fact it be, that at a particular hospital 29 attendants who had neither been re-vaccinated nor suffered from a previous attack of small-pox escaped the disease. It cannot be treated as an isolated experience, it must be considered in conjunction with the facts relating to other hospitals and to small-pox generally. If the inference suggested be that in the other instances it was a mere chance that the re-vaccinated showed immunity from the disease, and that they would have displayed the same immunity if they had not been a second time vaccinated, the facts seem to render such an inference impossible. At the Sheffield hospitals out of 62 attendants who had only been vaccinated in infancy, six contracted small-pox, as did another attendant who had been vaccinated in infancy and was not successfully re-vaccinated until incubating small-pox, whilst of the 80 others who had been re-vaccinated not one suffered. At Warrington two members of the hospital staff were attacked, being the only members who had not been re-vaccinated at the commencement of the outbreak. At Leicester, of the six attendants who refused to be re-vaccinated, five contracted small-pox and one died; whilst there was only one case of the disease, a mild one, amongst the larger number who had submitted to the operation, that of a nurse re-vaccinated ten years before. At Homerton almost all the hospital attendants were re-vaccinated, but three, on whom the operation had not been successfully performed, suffered from the disease. In Fulham Hospital seven of the attendants were attacked. None of them appear to have been successfully re-vaccinated. Dr. Grimshaw, the Registrar-General for Ireland, states that in the Cork Street Hospital, Dublin, with which he was at one time connected, all the officers and servants in the institution were re-vaccinated with the exception of one resident pupil, who refused to be re-vaccinated; he died of small-pox.

Q. 3000.

325. It will be seen, therefore, that if the hospital experience be regarded as a whole, there is clear evidence that whilst the re-vaccinated attendants escaped small-pox, many of those who had neither passed through an attack of small-pox nor been re-vaccinated were attacked by the disease. It is true that it cannot be asserted that persons employed in hospitals as medical men or attendants, even if re-vaccinated, enjoy an absolute immunity from the disease. There are instances of such persons having been attacked, but they have been so rare and exceptional as not substantially to modify the conclusion otherwise arrived at.

326. If the inference proposed be that attendants in a small-pox hospital enjoy, quite apart from vaccination, an immunity from the disease which is not shared by those who under other circumstances come within the reach of contagion, any such hypothesis seems to be equally inadmissible when the facts just alluded to are properly weighed. It is indeed not easy to understand why attendants in a hospital coming into constant contact with small-pox patients should be subject to less risk of contagion than those who nurse a member of their own family, or who are in communication with persons so engaged. Yet there is abundant evidence that contagion is constantly conveyed under these circumstances. The invasion of a house by a single case frequently leads to other attacks in the same house. There have been frequent attacks of small-pox among patients suffering from other diseases who have been inmates of a hospital a part of which has been used for small-pox patients. And there is strong evidence that small-pox hospitals have been the cause of a spread of the disease in houses in their proximity. These considerations must surely create a doubt whether what has been stated with regard to the South Dublin Union Hospital can be relied on as accurate, the more so when we find that the circumstances were not made the subject of careful and complete inquiry.

327. Our attention has been called to the experience at the Bicêtre Small-pox Hospital at Paris, recorded by M. Colin. It has been said that this shows that whilst out of 200 attendants, nearly all of whom were re-vaccinated under his eyes, 15 were attacked by small-pox with a fatal result in one case, there was not a single case of small-pox among 40 doctors and chemists and 40 nurses, nearly all of whom refused to be re-vaccinated. M. Colin's book does not enable us to arrive at a precise knowledge of the facts. The statements with reference to these incidents are found at different parts of it. It is stated that out of nearly 200 attendants on the hospital staff, almost all of whom were vaccinated under M. Colin's eyes, only some 15 were attacked by small-pox. It is to be observed that we are not told what was the number of those who were not re-vaccinated; for aught that appears, all or many of the 15 cases may have been amongst these. Moreover, unless M. Colin followed up the matter and ascertained that in the case of all the persons re-vaccinated under his eyes the operation had been successful, it is not certain that this was always the case. The experience gained by a study of the subject of re-vaccination elsewhere suggests caution on this head. On another page of M. Colin's book we find the statement that there was not a single attack of small-pox amongst the 40 doctors and chemists attached to the establishment in spite of the neglect of the majority of them to be re-vaccinated, and not a single attack amongst the 40 nurses who attended the small-pox patients. It will be noticed that this statement with reference to the neglect of re-vaccination is confined to the 40 doctors and chemists. Further, it is not certain whether it is intended to state that they had never been re-vaccinated, or merely that they had not submitted to the operation though advised to do so when they commenced their work at the hospital. In a subsequent passage where the fact that the doctors and chemists, and the nurses referred to, escaped small-pox is mentioned, it is added, "a large " number of these persons, however, were not willing to yield to the advice I gave them " to be re-vaccinated."

328. We do not think that the statements of M. Colin materially affect the weight of the evidence derived from hospital experience in this country. It will, of course, be noticed that both the Dublin and Paris cases only bear on the question of the value of re-vaccination as compared with primary vaccination; there is nothing to show that any of the persons who escaped the disease were unvaccinated.

It should be added that Dr. Ogle and others have called attention to the immunity enjoyed by medical men, who are largely a re-vaccinated class, from attacks of small-pox as compared with other contagious or infectious diseases.

329. It has been suggested that the true reason why those engaged in constant attendance in small-pox hospitals enjoy so exceptional an immunity from the disease, when the probabilities seem in favour of a risk much graver than the ordinary one, is this, that by a long and gradual exposure to the influence of the poison, the human frame becomes torpid in its action. But the facts do not support this explanation.

In the first place the exposure to the poison is not gradual, and further, this theory does not explain the phenomenon that the re-vaccinated so largely escape the disease as compared with those who have not been re-vaccinated.

Moreover, the experience of almost certain immunity from the disease in the case of successfully re-vaccinated attendants in small-pox hospitals has no parallel in the case of other contagious or infectious diseases.

Typhus fever is in many respects comparable with small-pox, especially in its contagiousness and in its attacking adults. Now at the London Fever Hospital during the period 1862–71, when large numbers of typhus patients were treated, the average number of attendants (including laundry-women) employed either temporarily or otherwise in the course of a single year was about 100, and the average number of cases of typhus occurring in a year amongst that staff was 19·2. It must be remembered that all these attendants were not employed in the typhus-wards; were it possible to obtain the separate figures of the number employed in those wards, the attack-rate would doubtless be higher. We are unable to state the exact proportion of the persons forming from time to time during the period 1862–71 the medical staff of the Hospital, who were attacked with typhus, but the following may be given as an instance of what at times happened. In 1862, the resident medical officer and a gentleman who temporarily discharged his duties both caught typhus; in the following year, the resident medical officer and three gentlemen who successively acted as his assistant all caught typhus; in the following year, the assistant resident medical officer, and in the year following that, another medical officer contracted the disease, while in the next year (1866) a resident medical officer took it and died. So great was the risk at that time of a new medical officer taking typhus, that each candidate was warned by the authorities of the danger to which he was exposing himself.

Neither scarlet fever nor measles can now, in respect to the question at issue, be compared with small-pox; since, as regards these two diseases, the proportion of adults protected by a former attack (in infancy) is one by the side of which the proportion in recent years of adults protected by a former attack of small-pox sinks into insignificance.

At the London Fever Hospital, since the time that typhus has almost disappeared, the cases of fever have been principally those of scarlet fever, and hence now among the medical staff and nurses the attacks of fever are comparatively few in number. In fact, the behaviour of scarlet-fever towards a hospital staff becomes comparable with that of small-pox, only on the hypothesis that a thoroughly good vaccination places a person towards small-pox in a position very similar to that which the having already had the disease places a person towards scarlet-fever.

Typhoid fever cannot fairly be compared with small-pox, since the mode of contagion is different. Nor are there records available as to the hospital staffs specially in care of typhoid fever or of diphtheria patients as there are in the case of small-pox. But if the cases of ordinary contagious diseases, such as scarlet fever and diphtheria, be taken together, and even if typhoid fever be included, a striking contrast is afforded by the returns of the Metropolitan Asylums Board between the attendants in the hospitals treating these diseases, and those in the small-pox ship-hospitals mentioned above. This is shown in the following table :—

Year.	Metropolitan Asylums Board's Fever Hospitals.*			Metropolitan Asylums Board's Small-pox Hospital-ships.		
	Number of attendants employed either temporarily or otherwise in the course of the year.	Of whom, there contracted scarlet-fever, diphtheria† or typhoid during the year.		Number of attendants employed either temporarily or otherwise in the course of the year.	Of whom, there contracted small-pox during the year.	
		Number.	Proportion.		Number.	Proportion.
1884 - -	Figures not available.			283	4	1·4 per cent.
1885 - -				240	0	0 ,,
1886 - -				110	0	0 ,,
1887 - -	1,103	37†	3·4† per cent.	55	0	0 ,,
1888 - -	Figures not available.	35	—	46	0	0 ,,
1889 - -		42	—	53	0	0 ,,
1890 - -	1,312	53	4·0 per cent.	64	0	0 ,,
1891 - -	1,160	68	5·9 ,,	64	0	0 ,,
1892 - -	1,652	121	7·3 ,,	138	2	1·4 ,,
1893 - -	2,175	121	5·6 ,,	320	6	1·9 ,,
1894 - -	2,182	111	5·1 ,,	289	0	0 ,,
1895 - -	2,514	116	4·6 ,,	274	0	0 ,,

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* Excluding the Gore Farm Hospital, opened in 1890. In the years 1893, 1894 and 1895, both scarlet-fever and small-pox convalescent patients were admitted into that hospital, and the only available figures as to the staff do not enable us to distinguish between those employed in or about the fever, and those in or about the small-pox wards.

† Cases of diphtheria, as such, were not admitted into the Metropolitan Asylums Board's hospitals prior to October 1888; though a few cases of that disease, sent in as fever cases, had been admitted in the earlier part of that year and in the previous year. Three attendants who contracted diphtheria in 1887 have not, therefore, been included in the number (37) and proportion (3·4 per cent.) given in the second and third columns of the above table against the year 1887.

Making every allowance on the one hand for the mixed character of the cases in the Fever Hospitals, and on the other hand for doubts about the re-vaccination of some of the staff at the ship-hospital, it is clear that small-pox stands apart from all the other contagious diseases in relation to attacks among the staff.

330. We have already in our discussion of the subject of re-vaccination alluded to its apparent effect in relation both to the military forces stationed at Sheffield and Warrington, and to public officials such as those employed by the Post Office, who by the regulations of the service are required to be vaccinated before entering it. It is needless to say that these are for the most part cases of re-vaccination. It will be expedient now to examine the evidence with regard to the Army and Navy generally.

In the British Army.

331. The following table shows the attack-rate of and mortality from small-pox amongst the troops in the United Kingdom during each of the years 1847–1894:—

2, App. 278–9; and reports of Army Medical Department for the years 1889–1894.

Year.	Attacks of Small-pox to every 10,000 of the Strength.	Deaths from Small-pox to every 10,000 of the Strength.	Year.	Attacks of Small-pox to every 10,000 of the Strength.	Deaths from Small-pox to every 10,000 of the Strength.
1847	18	1·0	1871	23	2·3
1848	26	1·6	1872	14	1·4
1849	25	3·2	1873	1	·1
1850	14	·7	1874	1	0
			1875	·6	·1
1851	14	·8	1876	3	·2
1852	30	2·1	1877	3	·4
1853	20	2·2	1878	2	·1
1854	41	4·5	1879	1	0
1855	47	3·8	1880	·4	0
1856	12	·4			
1857	12	1·0	1881	3	·2
1858	32	1·8	1882	2	·1
1859	21	1·0	1883	1	0
1860	14	·7	1884	1	0
			1885	2	·3
1861	6	·4	1886	1	0
1862	8	·4	1887	1	·1
1863	16	·8	1888	1	·1
1864	15	1·4	1889	·2	0
1865	12	·8	1890	0	0
1866	5	·1			
1867	5	·1	1891	·1	0
1868	9	·3	1892	6	0
1869	1	0	1893	·8	0
1870	3	·1	1894	1	0

Q. 3450–8; 3489–99.

332. Since the year 1858 it has been the practice in the army to vaccinate every recruit on joining the service, whether previously vaccinated or not, except those bearing distinct marks of small-pox. During the years following 1858, therefore, as men previously recruited passed from the army, the proportion of the strength who had been vaccinated since enlistment increased; until, in somewhere about ten years' time, the earlier recruits had, with comparatively few exceptions, left the army.

Q. 3500–7.

333. During the period 1847–1858 the death-rate from small-pox amongst the troops in the United Kingdom, though varying from year to year, does not appear to us to have given evidence of decline. Speaking generally of the period 1859–1894, the growth of the proportion of the strength who had been vaccinated since enlistment was accompanied by a decline in the death-rate from small-pox, and the lessened death-rate has on the whole continued during those later years of the period in which that proportion has presumably been maintained at its highest.

334. The following table shows the attack-rate of, and mortality from, small-pox among the British troops in the Colonies from the year 1860 onwards:—

2, App. 278 and reports of Army Medical Department for the years 1889–1894.

Year.	Attacks of Small-pox to every 10,000 of the Strength.	Deaths from Small-pox to every 10,000 of the Strength.	Year.	Attacks of Small-pox to every 10,000 of the Strength.	Deaths from Small-pox to every 10,000 of the Strength.
1860	8	1·0	1878	1	·4
			1879	·3	0
1861	12	·9	1880	2	·4
1862	15	2·3			
1863	5	0	1881	0	0
1864	16	1·5	1882	1	0
1865	12	1·1	1883	3	0
1866	7	0	1884	·5	0
1867	8	0	1885	1	0
1868	10	·3	1886	0	0
1869	4	0	1887	1	0
1870	8	1·3	1888	3	0
			1889	2	0
1871	51	7·0	1890	0	0
1872	·5	0			
1873	3	·5	1891	2	0
1874	2	0	1892	0	0
1875	5	0	1893	2	0
1876	0	0	1894	1	0
1877	·4	0			

335. The following table shows the attack-rate of, and mortality from, small-pox amongst the British troops in India during the same period:—

2, App. 278; and reports of Army Medical Department for the years 1889–1894.

Year.	Attacks of Small-pox to every 10,000 of the Strength.	Deaths from Small-pox to every 10,000 of the Strength.	Year.	Attacks of Small-pox to every 10,000 of the Strength.	Deaths from Small-pox to every 10,000 of the Strength.
1860	25	2·9	1878	12	2·3
			1879	6	·6
1861	40	6·1	1880	1	·2
1862	6	·8			
1863	8	1·8			
1864	21	2·9	1881	3	·2
1865	21	2·6	1882	8	·7
1866	6	1·0	1883	19	1·6
1867	8	·9	1884	14	1·4
1868	8	0	1885	2	0
1869	28	3·2	1886	4	·2
1870	4	·9	1887	6	·3
			1888	15	1·5
1871	2	·2	1889	22	2·5
1872	9	1·9	1890	5	·6
1873	14	1·9			
1874	8	1·3	1891	2	·2
1875	2	·3	1892	3	·4
1876	3	0	1893	5	·6
1877	7	·3	1894	2	·4

336. The following table shows the attack-rate of, and mortality from, small-pox amongst the British troops in Egypt during the years from 1882 onwards:—

2, App. 278; and reports of Army Medical Department for the years 1889–1894.

Year.	Attacks of Small-pox to every 10,000 of the Strength.	Deaths from Small-pox to every 10,000 of the Strength.	Year.	Attacks of Small-pox to every 10,000 of the Strength.	Deaths from Small-pox to every 10,000 of the Strength.
1882	5	0	1889	122	17·5
1883	10	3·8	1890	0	0
1884	39	1·5			
1885	54	4·2	1891	3	0
1886	46	2·7	1892	6	0
1887	49	7·6	1893	8	0
1888	42	12·0	1894	0	0

In order to maintain the same basis, the rates are stated as in the other tables in relation to every 10,000 of the strength, but except in the year 1886 the force in Egypt has never amounted to 10,000 men. It will be well, therefore, to give the actual figures, since a false impression as to the extent of the disease might otherwise be created. The actual figures are as follows :—

Year.	Strength.	Attacks of Small-pox (*actual number*).	Deaths from Small-pox (*actual number*).
1882 -	6,198	3	0
1883 -	7,897	8	3
1884 -	6,468	25	1
1885 -	9,593	52	4
1886 -	11,062	51	3
1887 -	5,272	26	4
1888 -	3,346	14	4
1889 -	3,431	42	6
1890 -	3,209	0	0
1891 -	3,172	1	0
1892	3,102	2	0
1893 -	5,073	4	0
1894 -	5,226	0	0

It will be seen that in the years 1887–89, and especially in the year 1888, the fatality was very high. We are not aware what is the explanation of this. It may be that small-pox prevailed in Egypt in a specially virulent form in those years.

There is a point connected with the returns of small-pox in the Army which must be borne in mind, not only in relation to the attacks of small-pox amongst the troops in Egypt, but with respect to the disease in the Army generally. It has been stated that the per-centage of unsuccessful re-vaccinations is often as high as 20 to 30 per cent. It is certain that soldiers are often disposed to withdraw if possible the vaccine matter, and thus to prevent vaccinia ensuing on the operation. Efforts are no doubt made to provide against this, but they are not likely to be always effectual. It may well have been the case, therefore, that a sensible per-centage of the men were not protected by successful re-vaccination.

In the British Navy.

337. The following table shows the attack-rate of, and mortality from, small-pox in the navy, wherever stationed, during each of the years 1860–1894 :—

2, App. 254.

Year.	Attacks of Small-pox to every 10,000 of the Force.	Deaths from Small-pox to every 10,000 of the Force.	Year.	Attacks of Small-pox to every 10,000 of the Force.	Deaths from Small-pox to every 10,000 of the Force.
1860 - -	51	3·9	1878 -	2	0
			1879 -	12	3·1
1861 - -	50	3·8	1880 -	2	·2
1862 - -	17	3·1			
1863 - -	22	2·8	1881 -	6	·7
1864 - -	87	6·2	1882 -	2	·5
1865 - -	32	2·9	1883 -	2	0
1866 - -	48	1·6	1884 -	1	0
1867 - -	49	2·7	1885 -	1	0
1868 - -	16	·4	1886 -	2	·6
1869 - -	17	1·0	1887 -	·2	0
1870 -	9	·2	1888 -	4	·2
			1889 -	1	·2
1871 - -	31	2·5	1890 -	1	·4
1872 - -	19	2·3			
1873 - -	3	·2	1891 -	3	0
1874 - -	2	·2	1892 -	2	·3
1875 - -	4	·2	1893 -	1	0
1876 - -	5	1·3	1894 -	3	0
1877 - -	4	0			

2, App. 255.
Q. 2645–6; 3210–2.
Q. 2651–7; 3212–9.

338. Since April 1864 it has been the practice in the navy to vaccinate every person entering the service, other than natives joining abroad. Before that date, though medical officers had been required to advise the men under their care to be vaccinated, there was no regulation enforcing vaccination. During the latter part of

the year 1864 and during the following years, as men who had previously joined left
the service, the proportion of the force who had been vaccinated since enlistment Q. 2654;
increased; until in March 1871, before this can have attained its maximum, an order 2659; 3220–
was issued for the vaccination of the whole force, whether the men had been previously 32; 3243–4;
vaccinated or not and even in cases where they had had small-pox. For some time, 3443.
however, after the issue of this order there existed no regulation enforcing the
vaccination of "foreigners," natives engaged abroad and discharged before their ship Q. 2670;
returns from her station; but in 1873 an order was issued for their vaccination on 3172–3;
enlistment. Since the year 1873 the force should, under the regulations, consist only 3226–34.
of persons who had been vaccinated since enlistment. Q. 3226–34.

339. During the period 1860–1864 the death-rate from small-pox in the navy gave no evidence of decline. Speaking generally of the period 1864–1894, the growth of the proportion of the force who had been vaccinated since enlistment was accompanied by a decline in the death-rate from small-pox, and the lessened death-rate has on the whole continued during those later years of the period in which that proportion has presumably been maintained at its highest. In the year 1879 the death-rate was, indeed, higher than it had been in any year since 1864; but ten out of the fourteen 6, App. 688. deaths from small-pox which occurred during that year (representing 2·2 of the death-rate of 3·1 shown in the table in § 337) were those of certain "foreigners," shipped on one particular vessel, whom the medical officer of the ship had, contrary to the Admiralty regulations, neglected to vaccinate. The vessel referred to is the "Boadicea." When at Sierra Leone, 37 Kroomen were shipped on board her. Sixteen of them showed evidence of having had small-pox in their youth, and two had vaccine marks on their arms. Twelve Kroomen were attacked in all, of whom 10 died. None of them had suffered from small-pox previously, and only one, who had the discrete form and recovered, showed vaccine marks. Twenty-four white men were attacked, of whom one only died. Of the remainder, four suffered from the confluent form, eight from the discrete, six from the varicelloid variety, and five from fever without any eruption. With one exception, faintly marked, all the white men had good cicatrices, some of them being due to re-vaccination.

340. We have further evidence also with regard to the postal service. Sir Charles Dilke, speaking in June 1883, made the following statement about those employed in that service in London:—"In the case of persons permanently employed in the postal service " in London, averaging 10,504, who are required to undergo vaccination on admission, " unless it has been performed within seven years, there has not been a single death " from small-pox between 1870 and 1880, which period included the small-pox " epidemic, and there have been only 10 slight cases of the disease. In the tele- " graphic department where there is not so complete an enforcement of vaccination " there have been only 12 cases in a staff averaging 1,500 men." When it is remembered how many of the persons so employed become subject in a degree exceeding that of the population at large to the risk of contagion, and that the period referred to included that of the epidemic in London of 1870–2, when there were so many attacks of and deaths from small-pox, the statement is certainly noteworthy.

We have not been able to obtain information bringing the statistics given above down to the present date. We have been furnished, however, with the following particulars:—

Year.	General Post Office.		
	Number of established officers employed.	Number of cases of small-pox.	Number of deaths from small-pox.
1891	47,264	*None.*	*None.*
1892	54,198	2	*None.*
1893	58,311	4	*None.*
1894	60,490	11	1

It is noteworthy that, in the year 1892, 12 officers were absent from duty on account of the presence of small-pox in their houses; in 1893, 44; and in 1894 as many as 53.

341. It should be mentioned that a study of the facts observed by the medical men who have investigated recent epidemics tends to the conclusion that the re-vaccina-

tion induced by the existence of an epidemic of small-pox has played no small part in checking the spread of the disease and narrowing its limits. It seems to have been a very important factor in controlling the epidemic.

342. Summing up, then, the evidence on the subject of re-vaccination so far as regards this country, we find that particular classes within the community amongst whom re-vaccination has prevailed to an exceptional degree have exhibited a position of quite exceptional advantage in relation to small-pox, although these classes have in many cases been subject to exceptional risk of contagion. We find, further, taking the evidence as a whole, that in the population at large re-vaccinated persons seem to be in a position much more advantageous not only than the unvaccinated, but than adults who have only been vaccinated in infancy.

There is another conclusion suggested by the evidence to which we ought to advert, for it is of importance. Where re-vaccinated persons were attacked by or died from small-pox, the re-vaccination had for the most part been performed a considerable number of years before the attack. There were very few cases where a short period only had elapsed between the re-vaccination and the attack of small-pox. This seems to show that it is of importance in the case of any persons specially exposed to the risk of contagion that they should be re-vaccinated, and that in the case even of those who have been twice vaccinated with success, if a long interval since the last operation has elapsed, the operation should be repeated for a third, and even for a fourth time.

343. A comparison has been instituted between the annual mortality from small-pox of males and females per million living at different ages for the three decennia between 1851–1880, and it has been suggested that an inference unfavourable to vaccination is to be drawn from this comparison, inasmuch as the mortality of males exceeds that of females, whilst the former were presumably the better vaccinated class. It is to be observed, however, that if the age below 15 be separately regarded, when infantile vaccination would be most protective, and when the conditions of exposure would probably be much the same, there is no substantial difference between the mortality of males and females. Above the age of 15, when the male population would be likely to be exposed to the risk of contagion more than the female, the deaths amongst the male population were considerably more than among the female. There is no reason to believe that this increased risk was counterbalanced to any material extent owing to a much larger proportion of the male population having been re-vaccinated than of the female. There is every reason to think that only a small proportion of either class had submitted to the operation of re-vaccination. The number of those who pass through the army is not large in proportion to the total population. And, on the other hand, the number of females employed as domestic servants, whose re-vaccination would be likely to be attended to, exceeds that of men so employed.

344. In discussing the effect of vaccination upon the fatality of small-pox, and the attack-rate and type of the disease, we have referred exclusively to materials derived from experience acquired in England. We have done so, because we posess the records of a careful examination into the circumstances of epidemics which occurred in that part of the United Kingdom. We have already insisted upon the importance of the reports which embody the results of those investigations. We do not possess any information of the same character with reference to the incidents of small-pox epidemics in other parts of the United Kingdom. We have not referred to the reports we received with regard to the other epidemics because they were of a more limited scope, and the information was derived more from other persons and less from a systematic investigation by the medical man appointed by ourselves. Nevertheless they contain much information with regard to the incidence of small-pox upon the vaccinated and unvaccinated which is in conformity with the results derived from the more complete investigation of the epidemics in the other towns. The records of the small-pox hospitals in London, which we have quoted, furnish the particulars of a very large number of cases. We have no similar records relating to anything like the same number of cases either in Scotland or Ireland. We have pointed out the superior value of statistical results, when derived from a large number of cases. For these reasons we do not propose to refer specifically to the evidence drawn from experience in Scotland or Ireland, bearing upon the question whether vaccination diminishes the fatality of small-pox or renders persons less liable to be attacked by, or to suffer severely from it. This much, however, we may say, that the evidence relating to those parts of the United Kingdom does not in any way tend to modify the conclusions to which a study of the evidence relating to England leads. On the contrary, its tendency is to confirm and strengthen them.

App. VIII.

Small-pox and vaccination in foreign countries.

345. We have hitherto made no reference in this part of the case to what is to be learned by an inquiry into the practice of vaccination and the records of the disease of small-pox in foreign countries. We do not propose to include in our report an exhaustive examination of the experience gained in other countries than our own; it would obviously carry us beyond all reasonable limits of space. We may, however, refer to some important facts which have been prominently brought to our notice.

346. It is worth noting, for example, that a change of the same nature as regards age incidence, which has distinguished the mortality from the disease in the present day from that prevailing in the last century, has been observed in Germany also. There are records of epidemics in that country during that century where the deaths were exclusively among those under 20 and almost exclusively among those under 10 years of age.

2, App. 232–3.

347. A comparison of the mode in which the very general small-pox epidemic of 1870–71 affected the German and French armies in those years is especially worthy of attention. In the year 1834, vaccination was made compulsory for soldiers in the Prussian army. Although it may not have been enforced with complete thoroughness, there seems to be no doubt that the German army was, on the whole, a well-vaccinated class at the time of the campaign of 1870–71. We do not think there can be any real doubt that the French army was, during the same period, in a condition in that respect less satisfactory. According to the official returns, the number of small-pox deaths in the German forces during the years in question was only 316. It was stated by Monsieur de Freycinet, when Minister of War, that 23,400 French soldiers died of small-pox during the years 1870–71. We have not been able clearly to ascertain how these last figures were procured. They were not derived directly from any official return. It would seem that the average derived from a limited number of returns relating to particular portions of the army was applied to the army as a whole. It is quite possible, therefore, that the figures given may not be accurate, and that the number stated is in excess of the real number of deaths; but we do not think it is possible to doubt that the ravages of small-pox in the French army were very great, and that the mortality was enormously in excess of that suffered by the force which was opposed to them. Various facts which have been deposed to, as for example, the small-pox deaths in the ranks of the French soldiers imprisoned in Germany, confirm this view, which receives further confirmation from a comparison of the small-pox deaths in the French and Prussian armies in the time of peace which immediately preceded the war. In 1869, there were 63 deaths from small-pox in the various French garrisons. In the four years from 1866 to 1869 there were 380 deaths from small-pox, 323 of them being in the active army. On the other hand, the total number of deaths from small-pox in the Prussian army from 1835 to 1869 was but 77.

Q. 1496; 6, App. 728.

6, App. 727; Q. 1545–7.

Q. 1543; 6, App. 728; 6, App. 727.

6, App. 725; Q. 1543–4; 2, App. 241.

348. Information of great importance is derived from an observation of the apparent effect of the law which was passed in Prussia in the year 1874 making re-vaccination compulsory. Since that period small-pox mortality in that country has been reduced to proportions quite insignificant as compared with any previous epoch. It is instructive in this connection to compare the deaths from small-pox per 100,000 of the population in Prussia and Austria. The deaths do not, of course, correspond year by year; sometimes they are higher in one country than in the other, and upon the whole the mortality shown is greater in the case of Austria than of Prussia, but in the period prior to 1874, there is no contrast to be found such as is observable since that year. The figures for 1874 and for some years prior and subsequent to that date are worth placing side by side.

6, App. 728.

—	Prussia.	Austria.	—	Prussia.	Austria.
1862	21·06	31·14	1872	262·37	189·93
1863	33·80	53·10	1873	35·65	323·36
1864	46·25	84·78	1874	9·52	178·19
1865	43·78	45·53	1875	3·60	57·73
1866	62·00	36·85	1876	3·14	39·28
1867	43·17	74·08	1877	0·34	53·18
1868	18·81	33·27	1878	0·71	60·59
1869	19·42	35·18	1879	1·26	50·83
1870	17·52	30·30	1880	2·60	64·31
1871	243·21	39·28	1881	3·62	82·67

349. In the year 1884 a Commission which had been appointed by the German Government to inquire into the subject of vaccination made their report, which, besides the comparison of Prussian and Austrian mortality just referred to, contains much valuable matter bearing upon the protective effect of vaccination. 6, App. 728.

350. Upon a review of all the information derived from other countries which we have had an opportunity of considering, it appears to us not to contradict, but, on the contrary, to confirm the experience acquired in this country. The same may be said, too, of the evidence which has been placed before us relating to India and the British Colonies.

351. Much criticism has been applied to the writings of Jenner, and of other early advocates of the practice of vaccination, and strenuous efforts have been made to show that their observations cannot always be relied on, and that their reasoning was at times unsound. This appears to us, even if it were established, to be of little importance as a guide to the conclusion which ought to be arrived at on the question whether vaccination affords any protection against small-pox. We have now in our possession the experience of more than half a century, during which facts relating to the effect of vaccination upon small-pox have been carefully recorded. If a study of this experience taught us that vaccination had not exercised any beneficial influence as a protection against small-pox, that the ravages of the disease were as great in the case of the vaccinated as of the un-vaccinated, and that no difference could be observed in the manner in which it treated the two classes, we could have no faith in vaccination as a prophylactic, however apparently accurate the observations of Jenner and his associates, or however apparently conclusive their reasoning. If, on the other hand, the reasonable conclusion, from an experience of more than half a century of the practice of vaccination, be that the vaccinated show less liability to attack by the disease of small-pox, or when attacked, suffer less fatally or severely, these facts cannot be displaced by showing that Jenner and his associates erred in some respects both in their observations and in the conclusions they founded upon them. It would, in our opinion, in that case, have been proved that however mistaken they may have been in other respects, they were right at least on this cardinal point, that the vaccinated enjoyed a position in relation to small-pox superior to that of unvaccinated persons. We think it would be as little reasonable to reject the conclusion to which the experience of vaccination led us, because Jenner and other early advocates of the practice made mistakes, as it would be to believe in its protective influence on account of the credit which seemed due to their judgment or observations, in spite of the lessons to the contrary taught by a lengthened experience of the practice. In saying this. we must not be supposed to admit that all the criticisms to which Jenner and his associates have been subjected are sound, or to give our adhesion to them ; we have desired only to point out why it seems to us of comparatively little importance whether they be so or not, and to assign to them their true place among the considerations which ought to guide us in determining the question whether or no vaccination has a protective influence.

352. When an attack of disease secures immunity or protection against another attack of disease, the two attacks are, as a rule, attacks of the same disease. Some pathologists have, it is true, of late years been led to suppose that one disease may confer some degree of immunity or protection against another different disease ; but instances of this are few, and, moreover, cannot be regarded as thoroughly established. The ordinary instances of immunity are so clearly those in which the attack, natural or artificial, which confers the immunity is of the same disease as that towards which immunity is conferred, that identity of disease has been considered as essential to the conferring of immunity. And it has been argued that it is *à priori* improbable that cow-pox should confer immunity from small-pox, seeing that the two are different diseases. Such a purely theoretical argument can have little weight against positive evidence of vaccination having actually conferred immunity. If this be definitely proved to be the fact, proof is thereby at the same time afforded that the theory is unsound, either because a particular disease may confer immunity against a different disease, or because small-pox and cow-pox are not different diseases. For the practical object with which alone we are concerned, it is not material that we should reach any conclusion upon the question what is the real source of error in the theory alluded to, supposing it to be erroneous ? We shall content ourselves, therefore, with a very brief notice of the subject.

As to the suggested identity of cow-pox and small-pox.

353. Jenner himself, in his first paper, advanced the view that the cow-pox and small-pox were identical with each other; and since his time numerous observers have attempted to prove the identity of the two diseases experimentally, namely, by giving rise to cow-pox in the cow through the inoculation of small-pox matter or by the introduction of contagion in other ways. It may at once be stated that while cow-pox is readily transferred from the cow to man and back again from man to the cow, the disease in man being identical with that in the cow, small-pox cannot be transferred from man to the cow so as to give rise to a disease in the latter identical in its features with the small-pox of man. Nor can cow-pox be so transferred to man as to give rise in him to small-pox. The two diseases are not in this sense convertible.

354. In most cases the attempt to transfer small-pox from man to the cow * has had simply a negative result; no obvious effect of any kind has been observed. This has been the case in the attempts to introduce the contagion through absorption by the respiratory or digestive organs, and in most of the attempts to introduce the contagion by inoculation. In certain instances these latter attempts have produced results which may be briefly described in three categories. (We may pass over the isolated experience of Thiele, who in 1838 asserted that by keeping small-pox matter sealed between glass plates for ten days before using it, and by diluting it with milk when using it for inoculation, the matter thus treated through ten removes through the human body (the cow not intervening at all) was converted into something which gave results identical with those of ordinary vaccine matter. We are not aware of any attempt to corroborate this experiment.)

355. The first category includes the experiments in which the inoculation of small-pox matter into the udder, or adjoining parts, of the cow gave rise at or near the seat of inoculation to a vesicle, either identical in visible characters with the ordinary vaccine vesicle produced by inoculation with the matter of cow-pox, or to a vesicle the features of which, while not corresponding wholly with those of a perfect vaccine vesicle, so closely resembled them as to justify the vesicle being called a vaccine vesicle. Further, the matter from a vesicle which at the first inoculation had not the characters of a perfect vaccine vesicle, when carried through a second or third remove in the cow, fully acquired those characters, and when transferred to man gave results indistinguishable from the ordinary vaccine vesicle. Indeed, lymph of such an origin has come into general use for vaccination purposes. Of the experiments, the best known or most quoted are those of Thiele (1838), Ceely (1840), Badcock (between 1840 and 1860), Voigt (1881), Haccius and Eternod (1890), King (1891), Simpson (1892), and Hime (1892); but there are several others. The details of the experiment are very scanty in the cases of Thiele and Badcock, but more full in the others, especially, perhaps, those of Ceely and Haccius.

6, App. 661–86; Q. 24,023 *et seq.*

356. In the second category may be placed the experiments of Klein and Copeman. Klein, who had in 1879 obtained in 31 trials what then appeared simply negative results, found in a renewed research in 1892 that the result of the first inoculation in the cow of small-pox matter was not a distinct vesicle but merely a thickening and redness of the wound. Lymph pressed from the thickened wound produced, when inoculated into a second cow, a like result, but rather more marked; the thickening and reddening still further increased with a third and a fourth cow. Lymph squeezed from the wounds of the fourth cow produced in a child typical vaccine, and crusts from the child produced typical vaccine in a cow. Copeman obtained somewhat similar results; the appearances increasing in three removes and approaching those of typical vaccine, but not reaching them.

Q. 26,940–27,061; 28,978–29,020, 29,037–42, 29,089–95.

357. The third category consists of the results obtained in an elaborate inquiry conducted by a Commission of the Society of Medical Sciences at Lyons, with Chauveau at its head. Those results, reported in 1865, were briefly as follows:—

Inoculation of the cow with small-pox matter in any one of the 30 animals used did not give rise to a vaccine vesicle. Nevertheless a definite result was obtained, in the form, however, not of a vesicle, but of a thickening and inflammation of the wound; when a puncture was employed this became a papule. Lymph squeezed from such a papule and inserted into a second animal gave rise to a like papule; and this, again, might be used for a third animal, but often failed; and the effect could in no case be carried on through more than three or four removes.

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* *Note.—"Cow" is here and in the following pages used, for brevity's sake, for the species irrespective of age and sex.*

When the inoculation was repeated on an animal in which a previous inoculation had produced such a papule, no distinct papule was formed, and, moreover, lymph squeezed from the seat of inoculation produced no effect at all when used for the subsequent inoculation of another animal. This shows that the development of the papule was the result of the specific action of the virus. The same is shown by the fact that no such papule was produced when the small-pox matter was inserted into an animal which had previously had cow-pox naturally or artificially, as well as by the fact that when an attempt was made to vaccinate, with vaccine matter of proved efficacy, an animal on which a papule had been so developed by inoculation with small-pox the vaccination failed, though the animal had never had natural cow-pox or had never been vaccinated. The specific nature of the lymph of the papule is further shown by the fact that such lymph when used on the human subject gave rise to veritable small-pox. It has been urged that in this case the virus producing the effect was simply the old virus used in the inoculation, producing the papule and still clinging to the wound. This is disproved by the experience that lymph *from a papule of the second remove* also gave rise in the human subject to veritable small-pox.

Thus Chauveau and his Commission found that small-pox implanted in the cow gave rise to a specific effect which was not cow-pox but was of the nature of small-pox, though its manifestations in the cow were different from those of small-pox in man. They also obtained similar results in attempting to transfer small-pox to the horse.

358. It must be admitted that the results finally obtained in some of the successful cases were indistinguishable from those of vaccination; the characters of the local vesicle, the absence of eruptive pustules and of contagiousness, show that the lymph thus apparently originating from small-pox in the hands of Ceely, Badcock, and others was vaccine lymph. It has been urged that a vaccine vesicle making its appearance in the wound of inoculation with small-pox was due to the accidental introduction of cow-pox matter into the wound; the small-pox matter in the wound produced no effect, and the cow-pox matter its usual effect. Several considerations support this view. The cow is peculiarly susceptible to cow-pox. In some cases (Ceely, Voigt), the animal was vaccinated as well as inoculated with small-pox; thus in Ceely's first case, the animal was inoculated with small-pox on one side of the body, and a few days after vaccinated on the other side. In many cases the experiments were conducted in an animal vaccine establishment, the stalls, the operating tables, and the assistants being those used or engaged in vaccination. It is true that in some cases at least special precautions, sterilisation of instruments and the like, were taken to avoid the accidental introduction of cow-pox; but in observations of this kind the difficulties of avoiding all such sources of error are notorious. Still the successful cases are now so numerous that it is difficult to resist the conclusion that the same accident could not have occurred in all, and that a transformation of small-pox into cow-pox—that is to say, into the artificially inoculated cow-pox which we call vaccine—really took place.

359. Accepting this view provisionally, it may be remarked that in most cases the transformation was sudden and complete; the small-pox virus, under the influence of the tissues of the cow, became immediately converted into vaccine virus, and this produced a typical vaccine vesicle. In some cases, *ex. gr.*, that of Hime, the transformed virus produced its effect not in the wound of inoculation, or not chiefly so, but at some little distance from it. In some cases the characters of the vesicle first formed, though sufficiently distinct to justify the vesicle being called a vaccine vesicle, were not those of a perfect vaccine vesicle, but the lymph from such a vesicle, at least after one or two removes, gave rise to most typical vaccine vesicles.

In Klein's experiments the transformation was gradual. In his fourth cow, the virus was as yet not typical vaccine, since it did not produce a typical vesicle; yet it was so far already vaccine that, transferred to the child, it produced typical vaccine (unless we suppose some accidental introduction of vaccine to have taken place). That the vesicle on the child was vaccine and not small-pox unaccompanied by eruptive pustules, was shown not only by its characters but also by the fact that lymph from it produced typical vaccine in the cow.

In Chauveau's experiments no transformation at all took place.

As has been urged in another place (discussion on Woodville's cases, pages 145–153), there are no adequate reasons leading us to believe that in the human subject the small-pox virus and the cow-pox virus can so act on each other as to form a hybrid disease. But this does not preclude the view that, accepting the conclusion that the body of the cow has the power to convert small-pox into vaccine, the virus may exist for a while in a phase in which, while ceasing to be typical small-pox, it has not yet fully acquired the characters of vaccine, and we may regard Klein's results as illustrating this. In some of the experiments—for instance, those of Ceely and Voigt—the results obtained with the lymph of the vesicle produced by the inoculation of small-pox give rise to the suspicion that the lymph had small-pox qualities, as seen, for example, in the case of Ceely's assistant, Taylor; but the facts cannot be said to be more than suspicious, they are not decisive. Moreover, admitting that the vesicle itself in such cases was the result of the transformed virus, some not transformed old virus might still remain dormant in the wound, and might be present in the lymph of the vesicle, mixed with the transformed and generating virus; this old virus might have happened to be in excess on the point of the lancet which wounded Taylor.

360. Taking all the various facts into consideration, we seem led to the provisional conclusion that under certain conditions the tissues of the cow are able to transform small-pox into vaccine, that these conditions may be such as to lead to the transformation being sudden and complete, that under certain other conditions the transformation may be gradual and incomplete, and that under certain other conditions, and these seem most commonly to obtain, the transformation into vaccine does not take place at all. But what the above conditions are has not as yet been clearly made out. It has been suggested that one condition favourable to the transformation is extreme youth of the subject; to effect the change the animal used should be a calf of not more than 3 or 4 months old, but this is not definitely proved.

Until these favourable conditions have been clearly recognised, so that, the conditions being fulfilled, the transformation will always be secured, the conclusion cannot be regarded as indisputable. Moreover, it must be borne in mind that effects more or less closely resembling a vaccine vesicle have been at various times obtained by various observers through inoculating man or the cow or another animal with material other than that obtained from the pustules of the small-pox of man. Much discussion has taken place concerning the "grease" of the horse, which Jenner believed to be the origin of the cow-pox of the cow. Without entering into any discussion of the matter, it may be said that investigation has shown that horses do suffer from a malady which, transferred to the cow, gives rise to a vaccine identical apparently with that produced by the inoculation of the natural cow-pox. Hence this malady is spoken of as the "horse-pox," and some cases at least of so-called "grease" appear to be cases of this horse-pox. But it is at least not proved that all the cases of "grease" which by inoculation were found to give rise to vaccine vesicles in man, were cases of true horse-pox. And this at least must be said, that no investigations as complete and varied as those which have been carried out with regard to the development of vaccine vesicles through the inoculation of small-pox matter, have been carried out with regard to the alleged development of vaccine vesicles by the inoculation of other material, such as the matter from the eruptions of the sheep-pox, the cattle plague, and the like. Nor have there been like extended inquiries as to the production of vesicles resembling those of vaccine by the inoculation of small-pox matter into animals other than the cow or the horse; such results as have been obtained by observers are conflicting. There is still room for much inquiry, meanwhile it may be said that, in any case, the evidence in favour of a possible transformation of small-pox into vaccine is sufficiently strong to remove the force of the theoretical objection to the power of vaccination to secure immunity towards small-pox, on the ground that the two diseases are absolutely distinct.

361. It may be well to advert to the fact that the protective effect, in relation to small-pox, of the much milder disease of cow-pox, is not an isolated phenomenon. It has been illustrated of late years in the investigations of Pasteur and others, showing in other communicable diseases of animals the means of so mitigating the virus, whether by transmission from one species to another or by various methods of cultivating or attenuating it, that a very slight disease produced by the milder form is yet protective against the more severe.

362. It appears to us that we may dismiss for practical purposes the theoretical questions which were discussed before us so fully. If the fact be established that the

introduction of vaccine matter and the consequent vaccinia produce some effect upon the human body which renders it less susceptible to small-pox, or which modifies that disease when the small-pox virus enters the system, it will not be a strange or unwonted experience that we should be unable to explain how this comes about. Science has not yet succeeded in freeing therapeutics or kindred subjects from obscurity, or in solving all the problems which they present. The precise *modus operandi* by which a previous attack of a disease furnishes security against a subsequent attack by the same disease, has not yet been elucidated. There can be no cause for astonishment, then, if we are unable to trace the steps by which vaccination exerts a protective influence, supposing the fact that it does so be established, nor is it essential that we should succeed in tracing them. Our inability to accomplish this does not seem to us to be the slightest reason for regarding with doubt the conclusions to which the facts lead us.

363. Professor Crookshank, than whom no one has more strongly insisted on the theoretical arguments against the protective influence of vaccination in relation to small-pox, gives it as his opinion that vaccination creates a transient antagonism to that disease. We understand his view to be that an attack of disease can only afford protection against the same disease, and that small-pox and cow-pox are not the same but different diseases. We gather, however, that in his opinion so long as the state of antagonism lasts, the person in whose system it exists is less likely to suffer from small-pox than he would be if the state of antagonism were wanting. This seems to us to amount in effect to the same thing as saying that during that period vaccination has conferred some protection. Whether the effect be to create antagonism or to confer protection, and whatever difference there be between the *modus operandi* in the one case and in the other, we know equally little about it. If a condition of transient antagonism to small-pox is induced by vaccination, theoretical considerations will not afford a guide of the slightest value to the conclusion how long this transient antagonism will last, or how soon it will pass away. Experience, and experience alone, can answer that question. *A priori* we do not see that there is any better reason for supposing that it would last for two or three years than that its duration would extend to 10 years.

364. If an impartial study of the facts led to the conclusion that small-pox treats the vaccinated and unvaccinated alike, this would throw, no doubt, an interesting light on the theories which have been advanced. If it leads to the contrary conclusion, then any theory inconsistent with it, especially any theory based upon hypotheses drawn from those obscure regions which science has not yet completely illuminated, may safely and wisely be disregarded.

Summary of evidence as to whether vaccination has any, and if so what, protective influence in relation to small-pox.

365. We proceed then to sum up the evidence bearing upon the question whether vaccination has any, and if so what, protective influence in relation to small-pox, and to state the conclusions at which we have arrived.

366. We find that the period which immediately followed the introduction of the practice of vaccination was characterised in all countries in which the practice prevailed by a marked though irregular diminution of small-pox mortality, and that this diminution of mortality, when compared with the century preceding vaccination, has continued in those countries down to the present time. We think this statement of the case is accurate, notwithstanding that the present century has witnessed epidemics of considerable severity even in countries where vaccination has largely prevailed. There has always been in those countries a class, more or less numerous, of unvaccinated persons who would, of course, be no less subject to the disease than if their neighbours, like themselves, had remained unvaccinated. Moreover, if it be true that experience has taught that the protective effect of vaccination diminishes in force, or for some purposes may even disappear, after the lapse of, say, 10 years from the date of the operation, there will be many of the vaccinated class liable to be attacked, and to suffer more or less from the disease, even conceding the protective effect of vaccination. We cannot think, therefore, that the fact that epidemics have from time to time occurred, and that deaths from small-pox continue, ought reasonably to be accepted as a proof that small-pox is uninfluenced by vaccination. In referring to the experience of the period which followed the introduction of vaccination, we are of course speaking generally. We have already considered the extent to which causes other than vaccination may have contributed to the diminished mortality from small-pox.

367. We observe next that there has been in the United Kingdom a remarkable change in the age-incidence of small-pox. The change does not appear to have been confined to this country, but we limit our remarks to it, because we have not as precise information on the point in the case of other countries. This change in the age-incidence appears, on the whole, to have become increasingly marked as the infantile population came to be more completely vaccinated. On the other hand, we have seen that where vaccination has been neglected or practically abandoned, a small-pox epidemic has been characterised by a very large mortality among children, when compared with the mortality exhibited in a well-vaccinated place visited by an epidemic of the same disease. This affords support to the view that vaccination is of protective value against a fatal result in the case of persons attacked by small-pox, and that its protective power is greatest during the early years after vaccination has been performed. We are unable to see that any satisfactory explanation has been given of the phenomenon now under consideration except that just indicated. We are indeed quite unable to appreciate the bearing of some of the circumstances which have been put forward as explaining it. As to others, such as improved sanitation, we have already pointed out that they do not really afford any explanation of the phenomenon when viewed, as it must be, in connection with the age-incidence and mortality found to prevail in the case of other diseases.

368. There is further strong evidence that where attacks of small-pox occur the fatality is far less in the case of the vaccinated than of the unvaccinated, and that this difference is much more marked in the first 10 years of life than at a later period. We have given full effect to all the considerations which have been urged with the view of showing that the division into vaccinated and unvaccinated cannot be relied on as accurate. We quite admit that absolute accuracy may not have been obtained in any of the instances in which this discrimination has taken place, but looking at the matter fairly as a whole, we cannot but believe that the division may for all practical purposes be regarded as substantially accurate. Indeed for the most part, it would seem to err, if at all, in representing the vaccinated class as comparing less favourably than it really ought with the unvaccinated, for all cases of doubtful or alleged vaccination have been included in the vaccinated class, and whatever errors there may have been in erroneously placing vaccinated cases in the unvaccinated class, we think that they are counterbalanced by errors in the opposite direction. We think the improbability extreme, indeed it seems to us to reach the point of incredibility, that the fatality in classes of persons discriminated on different occasions by so many different observers, only on the ground that vaccination was believed to be present in the one and absent in the other, should always show so very wide a divergence, unless there were some real difference in the liability to a fatal attack of those included in the one class as compared with those comprised in the other.

We can see nothing to differentiate them in this respect save that the one class possessed, while the other did not, the protection of vaccination, unless it be the circumstance suggested that the unvaccinated were drawn from a more neglected, and therefore from a less robust, portion of the population. We have already given our reasons for thinking this explanation quite insufficient to account for the phenomenon.

369. We notice further that the same classes of vaccinated and unvaccinated persons, which display when attacked by small-pox so marked a contrast in the fatality of the disease, manifest a contrast no less marked in the type of the disease from which they suffer, viewed in relation to its severity or mildness. Here again, unless vaccination be regarded as the determining cause of the difference, it would remain to us, after considering all the explanations which have been vouchsafed, an unsolved mystery.

370. The next point forced on our attention is the greater liability to attack which the evidence shows to exist in the case of the unvaccinated than of the vaccinated. We are of course again confronted by the possibility of error in the classification, but the same test was applied in dividing into the two classes those who inhabited the invaded houses as in making a similar division in the case of the individuals attacked. It is possible, too, that the inhabitants of the invaded houses included in the two classes were not all equally within the reach of contagion, but any error in this respect is just as likely to have affected the vaccinated as the unvaccinated class. When the numbers dealt with are considered, and it is remembered that the classification was made in different

towns and always with the same result, we do not think this source of possible error can be regarded as serious.

371. When we find again that, both as regards the type of the disease and the attack rate, the contrast is specially noticeable in those under 10 years of age, and that the explanations proposed are even less deserving of weight when applied to these phenomena than when regarded as a reason for the difference in the fatality of the disease in the two classes, the conclusion that vaccination exercises an influence in relation to small-pox, specially potent during the early years after the operation, to which, as we have already indicated, other considerations point, receives strong confirmation.

372. We see no reason for hesitating to adopt the conclusions to which we should otherwise be led, or to doubt the accuracy of the facts to which we have been adverting, on account of the objection, even if it be well founded in fact, that the fatality among the unvaccinated at the present day exceeds that experienced before the era of vaccination. We have already pointed out that in the statistics of modern times, with which we have been dealing, the fatality among the unvaccinated varied greatly, and it is by no means established that there were not as great variations in the pre-vaccination days.

373. It has been suggested that a comparison in the case of certain towns for the years 1892–93, of the attack-rate and mortality from small-pox, with the average annual default of vaccination for the previous 10 years, shows that there is no connexion between the amount of vaccination and the attack-rate of or mortality from small-pox. It is a sufficient comment upon this to point out that Gloucester stands very high in that comparison as a place where there had been much default of vaccination and very little small-pox.

374. We have still to notice two other groups of facts bearing upon the question. We have shown that there is evidence that where vaccination has been most thorough the protection appears to have been greatest. It may be that on this point the force of the evidence is less than on some of those just alluded to; nevertheless it cannot be left out of sight, or regarded as of no importance, when we are seeking an answer to the question whether vaccination has a protective influence, or is altogether ineffectual.

375. The fact that the revaccination of adults appears to place them in so favourable a condition, as compared with the unvaccinated,—and that, too, even when they are subjected to specially grave risk of contagion, and we take this to be established as a fact—affords further confirmation of the conclusions suggested by the evidence which we have already passed under review.

376. We have hitherto, save for a cursory reference to the bearing of some of the facts upon one another, treated the various tests which have been applied to ascertain whether vaccination has a protective effect separately and independently. We have found that in each case the result of the test has been to suggest an affirmative answer to the question. In order to estimate the value of the evidence aright, it is necessary to consider in conjunction all the tests which have been adopted, and the results which they exhibit. They are, it is true, independent of one another, and have been separately applied in a number of cases. But the greater the number of tests employed, and the greater the number of cases to which they are applied, the more certain is it that the play of chance, or the influence of other causes, will be excluded, and the more safely may the conclusions to which they lead be acted upon. The cumulative force of a number of independent pieces of evidence, all pointing in the same direction, is very great indeed. Even if a more or less plausible answer could be suggested in the case of each one of them standing alone, the cumulative force of the testimony might still be irresistible. We think those who have denied the efficacy of vaccination have often lost sight of the circumstance that investigations, which have followed so many different roads, have all led to the same end.

Conclusion on this point.

377. We have not disregarded the arguments adduced for the purpose of showing that a belief in vaccination is unsupported by a just view of the facts. We have endeavoured to give full weight to them. Having done so, it has appeared to us impossible to resist the conclusion that vaccination has a protective effect in relation to small-pox.

We think:—

1. That it diminishes the liability to be attacked by the disease.
2. That it modifies the character of the disease, and renders it (*a*) less fatal, and (*b*) of a milder or less severe type.
3. That the protection it affords against attacks of the disease is greatest during the years immediately succeeding the operation of vaccination. It is impossible to fix with precision the length of this period of highest protection. Though not in all cases the same, if a period is to be fixed, it might, we think, fairly be said to cover in general a period of nine or ten years.
4. That after the lapse of the period of highest protective potency, the efficacy of vaccination to protect against attack rapidly diminishes, but that it is still considerable in the next quinquennium, and possibly never altogether ceases.
5. That its power to modify the character of the disease is also greatest in the period in which its power to protect from attack is greatest, but that its power thus to modify the disease does not diminish as rapidly as its protective influence against attacks, and its efficacy during the later periods of life to modify the disease is still very considerable.
6. That re-vaccination restores the protection which lapse of time has diminished, but the evidence shows that this protection again diminishes, and that, to ensure the highest degree of protection which vaccination can give, the operation should be at intervals repeated.
7. That the beneficial effects of vaccination are most experienced by those in whose case it has been most thorough. We think it may fairly be concluded that where the vaccine matter is inserted in three or four places, it is more effectual than when introduced into one or two places only—and that if the vaccination marks are of an area of half a square inch, they indicate a better state of protection than if their area be at all considerably below this.

(*B.*) *As to the objections made to vaccination on the ground of injurious effects alleged to result therefrom; and the nature and extent of any injurious effects which do, in fact, so result.*

378. We proceed to address ourselves now to another subject submitted to us, viz.: "the objections made to vaccination on the ground of injurious effects alleged to result "therefrom; and the nature and extent of any injurious effects which do, in fact, so "result."

379. This is obviously a matter of great importance. Not only has the utility of vaccination been denied, but it has been asserted that mischievous effects have been due to it, resulting in personal injury and in the loss of life. If the practice has been productive of substantial benefit in limiting the ravages of small-pox, and mitigating the severity of the disease, the fact that vaccination may lead in certain cases to personal injury or death, would of course not be a conclusive argument against its use. Danger of personal injury, and even of death, attends many of the most common incidents of life, but experience has shown the risk to be so small that it is every day disregarded. A railway journey or a walk in the streets of any large town certainly involves such risks, but they are not deemed serious enough to induce anyone to refrain from that mode of travelling or from frequenting the public streets. And to come within the region of therapeutics, it cannot be denied that a risk attaches in every case where chloroform is administered; it is nevertheless constantly resorted to, where the only object is to escape temporary pain. The admission, therefore, that some risk attaches to the operation of vaccination, an admission which must without hesitation be made, does not necessarily afford an argument of any cogency against the practice, if its consequences be on the whole beneficial and important, the risk may be so small that it is reasonable to disregard it. Everything depends, then, upon the extent and character of the risk.

380. Those who have assailed vaccination on the ground of the evil consequences which are said to flow from it, have adopted two lines of attack. They have asserted that evidence of its mischievous influence is to be traced in an increase in the number of deaths from certain specified diseases, corresponding with a spread of the practice

of vaccination, of which increase vaccination was, they alleged, really the cause. They have further insisted that evidence of the evil effects it produces is furnished by an examination of particular cases in which it has been found that injury or death has resulted from the operation.

381. We shall examine in the first place the contention that the records of mortality show an increase in the deaths from certain diseases during periods of extensive vaccination when compared with those when the practice was less in use, and that it may be fairly inferred, from this comparison, that vaccination was the cause of that increase.

382. It is to be observed that the diseases selected for such a comparison by the opponents of vaccination have not always been the same. In 1877, a return was obtained by an Order of the House of Commons, showing the deaths from 14 diseases at three periods, viz., 1847–1853, 1864–1867, 1868 to 1875; these periods having been regarded as distinguished from one another by a progressive advance in the number of vaccinated persons, especially children. The diseases were, tabes mesenterica, diarrhœa, bronchitis, pyæmia, skin disease, syphilis, convulsions, cholera, diphtheria, pneumonia, atrophy and debility, whooping cough, erysipelas, scrofula.

383. The first six of these diseases showed an increasing, the next four a decreasing, mortality, whilst the remaining four exhibited an irregular mortality, there being in three cases an increase in the second period, and a decrease in the third, and in another case a decrease in the second, but a slight increase in the third, when, however, the mortality was not so high as in the first period. When all the diseases were taken together, there appeared to be in the aggregate an increasing mortality. Some found in this circumstance evidence of the malign influence of vaccination. Such a conclusion is manifestly untenable. There was no more reason for attributing to vaccination the increase of mortality in the case of those diseases where the mortality had grown, than there was for asserting that to its beneficent influence was due the decrease of mortality in those cases in which the mortality had become less. The hypothesis that it caused the mortality in some instances to grow, and in other instances to decrease, and that it was responsible for the balance of increase shown on an aggregation of the two, does not merit serious attention. It is not as if all the diseases in the class showing an increasing mortality were such as could be deemed capable of being affected by vaccination, whilst those included in the class with a decreasing mortality were in a different category. Two of the diseases included in this latter class, viz., convulsions and pneumonia, have been regarded in particular cases, even on recent occasions, as having had their origin in vaccination.

Q. 27,187. 384. Dr. Ogle, in statistics drawn from the Reports of the Registrar-General for England and Wales, points out that the line of reasoning which had been considered by some sufficient to show that vaccination has produced in those who have been subjected to it, serious diseases, would equally serve to show that it has rendered them largely exempt from other diseases no less serious. He gives, as an example, the mortality from phthisis, pneumonia, convulsions, and from causes not ascertained or stated too vaguely for classification, and shows that, in each case, there has been a large decrease of mortality during the period from 1874 to 1891. He does not, of course, suggest that vaccination has been the cause of this decrease, but he asks, and we think the question a pertinent one, why it should be credited with the increase of diseases which have increased, and not equally be credited with the decrease where the mortality has diminished. 6, App. 646.

385. We will refer now specifically to the principal diseases, an increase in the mortality from which is at the present day charged against vaccination. Before doing so, it will be well to enquire whether infant mortality has shown an increase during the period into which we are enquiring. Vaccination is, in the vast majority of cases co-incident in point of time with this stage of life. If, then, it is the parent of other diseases, and has substantially augmented the number of deaths due to them, we should expect to see some effect produced on infant mortality as a whole, yet it is clear that the mortality of infants in the first year of life, as measured by the proportion of their deaths to births, has not increased at all during the times when infant vaccination has been increasing. The figures show that from 1838 to 1842 the annual infantile
6, App. 645. death-rate to one thousand births was 152; from 1847 to 1850 it was 154; in the

next decennium, 1851 to 1860, it was again 154; in the next decennium, 1861 to 1870, it was 154 for the third time. From 1871 to 1880 it fell to 149, and from 1881 to 1890 it further fell to 142. Q. 27,187.

386. Turning now to specific diseases, we will begin with syphilis. We shall confine ourselves for the present as regards this and other diseases exclusively to the question whether there is evidence that according as vaccination has more extensively prevailed the mortality from them has been greater and whether where such an increase is established there is evidence to justify its being attributed to vaccination.

387. It is the fact that deaths from syphilis have increased in the last 20 years among infants under one year of age. But the records of the mortality from the disease show that it is most largely fatal in the first three months of life. Such statistics as we have on the point indicate, too, that in England and Wales the increase has been greatest in that portion of the first year of life which would be practically unaffected by vaccination. There is certainly not the slightest sign of a cause operating, in the later portion of that age period, to increase the mortality from syphilis, which is absent in the first three months of it.

It may, indeed, be suggested that as three months is the age of compulsory vaccination in England and Wales that age period rather than a later one would exhibit the effect of syphilis resulting from vaccination. There is, however, no doubt that the number of vaccinations taking place much before the age of three months is small; and if syphilis or any other disease supervened upon it, there would be an interval between the vaccination and the death caused by that disease. The matter is, we think, put beyond doubt by an examination of the particulars of the 205 cases in which deaths occurring between the 1st November 1888 and the 30th November 1891 were attributed to, or said to be connected with, vaccination, and which were investigated by the Local Government Board. In the case of 158 of these deaths the age exceeded three months, in the majority it was over four months. Only 20 were recorded as below the age of three months. In the remaining cases the age was not stated. App. IX.

388. When we apply ourselves to the case of Scotland the supposed influence of vaccination in generating syphilis has to be tested in a somewhat different manner. The age of compulsory vaccination is there six months instead of three, so that a comparison has to be made between the mortality from syphilis in the first half and in the second half of the first year of life. There is nothing in such a comparison to lead to the belief that vaccination has increased the prevalence of syphilis. Taking the period of 1855–1863, immediately preceding that of compulsory vaccination, the proportion of deaths from syphilis in every 1,000 deaths in Scotland from that disease was at the age 0–6 months, 575. In the period 1864–1875 the corresponding proportion was 612. and in the period 1875–1887 it was 647. In the same periods the similar proportions of deaths at the age 6–12 months were 109, 118, and 109 respectively. It will be seen that while the proportion of deaths at the age 0–6 months had considerably increased between the periods 1853–1863 and 1876–1887 the proportion at the age 6–12 months had remained stationary. The proportionate increase in the number of deaths between the two periods was also greater in the case of the former than in the case of the latter age period. 6, App. 641.

The observation we have just made with regard to England, that deaths due to an illness produced by and supervening on vaccination would chiefly show themselves in the age period succeeding the time fixed for compulsory vaccination, applies equally to Scotland.

389. A statistical statement which has been placed before us shows that the number of deaths of infants from syphilis, in Ireland, has largely diminished during recent years. During the two years 1864 and 1865 it averaged 124, while during the two years 1887 and 1888 (the last for which we have the particulars) the average was only 40. Without suggesting any explanation of this remarkable reduction, it certainly affords strong proof that in Ireland vaccination has not been influential in increasing the prevalence of the disease in question. 2, App. 275.

390. Further evidence on the same point, of great importance, is afforded by a consideration of the statistics showing the deaths from syphilis under one year of age per

million births in Leicester on the one hand and in England and Wales on the other. 6, App. 646. The Registrar-General has supplied us with the means of comparing the deaths in the period 1863–1867 with those in the period 1883–1887. We have already seen that the latter years were marked by a great decrease in the practice of vaccination amounting at last to a practical disuse of it. If vaccination were, to any serious extent, a cause of syphilis we should have expected to see some evidence of it in these comparative records of the mortality of infants under one year of age. Yet we find that whereas in England and Wales there was as between the former period and the latter an increase in the infant mortality from syphilis in England and Wales of 24·7 per cent. only, the increase between the same periods in Leicester was no less than 69·3 per cent. This does not, of course, imply any connection between the disuse of vaccination and the increase of infantile syphilis. It does, however, conclusively rebut the argument of those who seek to connect the increase of mortality from syphilis with the practice of vaccination.

It has been observed that the comparison is made between Leicester, which is an urban population, and the whole of England and Wales, which would comprise a large rural population. This is no doubt true, but it is true for both periods alike. It does not appear to us materially to vitiate the comparison for the purpose of disproving the allegation that the great increase of syphilis during the last 20 years is due to vaccination.

Even if it can be shown that in some instances syphilis has been inoculated by vaccination, the conclusion would still remain that this cannot have been so to any substantial extent.

391. We take next cancer. There can be no doubt that the mortality from cancer shown by the registered causes of deaths has considerably increased in recent years. This disease is, it must be remembered, one to which persons of advanced years are specially subject. The young are seldom its victims. And the increase of mortality from it has, for the most part, affected adults and principally old people. There has been an actual decrease in the mortality from the disease of those under five years of age. In the second and third quinquenniads of life there has also been a decrease—it is only in later age periods that the mortality begins to rise, and the rise becomes more and more pronounced as the age increases. The increase is, therefore, greatest in the age period furthest removed from the time of vaccination, whilst in the age period nearest to it there is an actual decrease. This of itself would seem enough to acquit vaccination of the charge of having caused an increased mortality from cancer, even if the origin of that increase remained in complete obscurity. This, however, is not the case. The Registrar-General points out that there can be very little doubt that the increase is to a considerable extent apparent only, and is simply due to improved diagnosis, and more careful statement of the cause of death on the part of medical men. He calls attention in connection with this to the fact, that year by year the number of deaths ascribed to tumours, abdominal disease, or other similar imperfectly stated causes, has been undergoing diminution. This explanation of the increase of mortality shown by the registered causes of deaths receives support from the fact that the increase of mortality from cancer has been much greater among males than females, the rate for males having risen 62 per cent. in 20 years, while the rate for females rose only 43 per cent. As the Registrar-General observes : "The cancerous affections of males " are in much larger proportion internal, or inaccessible, than are those of females, and " consequently are more difficult of recognition, so that any improvement in medical " diagnosis would add more to the male than the female reckoning." It may be that, in addition to the apparent increase there has been some real increase in the mortality from cancer, but there is not a shadow of evidence to connect this with the practice of vaccination, whilst there is, as we have shown, evidence pointing the other way.

392. It is clear that whatever diminishes mortality in early periods, and favours the survival to middle age and beyond it, must necessarily tend to increase both the actual and relative mortality from any disease, such as cancer, which is a disease almost exclusively of middle and senile periods of life. It was to be expected, therefore, that vaccination, in conjunction with improved isolation methods and other precautions, having reduced the deaths from small-pox in the earlier periods of life, and the general mortality being less, there would be some increase in the number of deaths from cancer.

393. Next in order let us consider the case of erysipelas.

This is a disease largely affecting children, and, as Dr. Ogle showed in his evidence, chiefly in the first three months of life, *i.e.*, before the time when, as a rule, a disease supervening on vaccination would end in death. The annual death rates of infants from this disease, taken over a long series of years, per million living at each age period was, under three months, 1,905; aged three months but under six months, 774; six months but under one year, 268. He also drew attention to the fact that the mortality from erysipelas rose and fell in correspondence with the mortality from puerperal fever, which suggested an explanation of some part at least of the large mortality under the age of three months. Q. 27,210–27. 6, App. 647. Q. 27,222.

394. The last parliamentary returns, obtained with a view of ascertaining the relation of vaccination to certain diseases, do not afford any evidence of an increase in the mortality from erysipelas. They show on the whole a diminishing mortality from that disease among the infant population.

An examination of the per-centage during the first and second six months of life of the total mortality from erysipelas during the years 1855 to 1863, as compared with the years 1864 to 1887, has been obtained from the Registrar-General for Scotland. In that part of the United Kingdom vaccination seldom takes place much before the age of six months. The period first selected is that preceding the Act making vaccination compulsory in Scotland. An examination of this return certainly does not lend any countenance to the view that vaccination exercises a serious influence on the mortality from erysipelas. In the earlier period the per-centage of deaths within the first six months to the total deaths was 28·36; in the second period it was 28·88. In the earlier period the similar per-centage relating to the second six months of life was 5·02; in the later period it was 5·35. The changes it will be seen are very slight. There is certainly nothing to show that a new cause for gravely increased mortality had come into existence during the later period. It is worth turning again to the Leicester statistics. Comparing the years 1883 to 1887 with the years 1863 to 1867 we find that whereas in England and Wales there had been a decrease in the 20 years of 16·7 per cent. in the infant mortality from erysipelas, there had been at Leicester an increase of 41·5 per cent. As before observed, the comparison is made between Leicester and the whole of England and Wales, but this does not appear to us materially to vitiate the comparison for the purpose of disproving the allegation that there has been a substantial increase in mortality from erysipelas due to vaccination. 6, App. 641. 6, App. 646.

395. It may well be that in some cases vaccinated children have suffered fatally from erysipelas who, but for the operation of vaccination, would not have been attacked by the disease. This is a point we shall have to consider presently. But the evidence is, in our opinion, conclusive to show that there has not been during the last 40 years any material increase of deaths from erysipelas owing to vaccination.

396. Passing on to tabes mesenterica and scrofula, we find that the mortality from these diseases, as returned to the Registrar-General, shows an increase during the last 40 years. On the other hand, the mortality from allied diseases, such as hydrocephalus and phthisis shows a decrease. Some part, and it is impossible to say how much, of this increased mortality in the case of the two first-named diseases, and of the decrease in the two last named, is apparent only and not real, and results no doubt from better diagnosis leading to a transfer of cases from one class to another. On this point again it is useful to resort to the experience of Leicester. The increase of deaths under one year from tabes mesenterica and scrofula per million births in Leicester during the years 1883–87, as compared with the years 1863–67, was 25·8 per cent. A similar comparison for England and Wales shows a per-centage of 26·8 per cent. 6, App. 646.

We do not find any facts to warrant the assertion that the increased mortality from tabes mesenterica and scrofula, or any part of it, was due to vaccination.

397. Without encumbering our report with the details relating to pyæmia, bronchitis, diarrhœa, and skin diseases, which are all said to have increased owing to the mischievous influence of vaccination, we may confidently say that there is no evidence to justify the statement. It is, however, worth while pointing out that comparing, as before, the period of 1883–87 with the period of 1863–67, the increase of deaths under one year of age from diarrhœa and dysentery in Leicester was 4·2 per cent., whereas in England and Wales it was 0·5 per cent. A similar comparison in 6, App. 646.

respect of bronchitis shows the increase in Leicester to be 112·8 per cent., in England and Wales 73·3 per cent. It seems clear that as regards general infantile mortality Leicester has not gained by its avoidance of vaccination. Whilst in England and Wales the mortality of children under one year of age had between the periods selected for comparison decreased 7·5 per cent., in Leicester the decrease was only 2·8 per cent.

398. Upon the whole, then, we think that the evidence is overwhelming to show that, in the case of some of the diseases referred to, vaccination cannot have produced any effect upon the mortality from them, and that it has not in the case of any one of them increased the mortality to a substantial, we might even say an appreciable, extent.

399. When we pass to a consideration of the evidence that personal injury or death has resulted from vaccination, the questions which present themselves do not admit of the same simple solution as those with which we have just been dealing. The cause of death, or the nature of an illness, is sometimes obscure, and even if its nature be known, it may be difficult to ascertain with certainty what has been its origin. We shall have to make further reference presently to the difficulties which must needs be encountered in the investigation upon which we are engaged. As we have already stated, it is not open to doubt that there have been cases in which injury and death have resulted from vaccination.

400. In the years 1859–67 the deaths returned as due to erysipelas after vaccination varied from 2 to 13; the annual average being 6·8. From 1868–71 inclusive they varied from 9 to 24; the annual average being 18·0. From 1859–71 the population of England and Wales had increased from 19 to 22 millions. In addition to this there can be no doubt that the number of children vaccinated increased very much between 1868 and 1871, as compared with the previous period, owing to the legislation of 1867. Of course the greater the number of the vaccinated amongst the children born in any given period the greater, *cæteris paribus*, would be the number of cases of erysipelas after vaccination, without any necessary connexion between the two. The same remark applies to the period between 1872 and 1880, when the cases returned as erysipelas after vaccination varied from 16 to 39; the annual average being 28·5. The Act of 1871 undoubtedly increased largely the number of infantile vaccinations in this period as compared with that which preceded it. In subsequent years erysipelas after vaccination was not separately recorded, being included under the heading "cow-pox and other effects of vaccination." There were 283 such cases in the years 1881–85.

401. During the years 1886 to 1891 the cause of death was in 279 cases certified as connected with vaccination. Many of these cases were the subject of special inquiry by the Local Government Board. We have had before us a summary of the reports made to the Board of the result of such inquiries, prepared for us by Dr. Acland and Dr. Coupland. The reports referred to cover the period from the 1st of November 1888 to the 30th of November 1891. We have ourselves, in many instances, instituted independent inquiry. App. IX.

402. The cases in which the death has been certified as connected with vaccination cannot all be regarded as cases in which there was the link of causation between them. Indeed, the medical men whose certificates associated the two did not always intend to indicate that the disease which ended in death had its origin in vaccination. There have, no doubt, been other cases in which, although the illness which ended fatally was engendered by vaccination, there has been no mention of it in the certificate of death. Whether these are sufficient in number to counterbalance, or more than counterbalance those in the other category, the evidence does not enable us to say.

403. Taking for the moment the 279 deaths during the years 1886 to 1891, certified as connected with vaccination, to have been really so connected, how does this figure compare with the number of vaccinations effected during the same period. The number of primary vaccinations during the years 1890 and 1891 were not put before us by Dr. Ogle, they had not then been published. He stated, however, that in the years 1881 to 1889, inclusive, the number of deaths certified as connected with vaccination was 476. During those same years there were 6,739,902 primary vaccinations, 6, App. 647.

showing the proportion of one death to 14,159 primary vaccinations. There is, no doubt, that for the years 1886–91, it was not substantially different. For the reasons stated in the preceding paragraph it is not possible to fix with absolute certainty the number of deaths connected with vaccination.

404. In the case of Scotland, during the years 1883 to 1890 inclusive, the deaths registered from cow-pox and other effects of vaccination were 22. During the same years the number of persons successfully vaccinated was 855,185. This shows the number of cases in which the death was stated to have been due to vaccination to be one to every 38,872. It is not easy to say what is the cause of the difference in this respect between England and Scotland. It may be that it is the practice in the latter country to require more evidence of the connexion between the death and vaccination before associating the two in the certificate, though it does not seem likely that this can be the explanation of the whole of the difference. It is worth noting that the proportion of deaths to vaccinated cases is much the smaller in the country where vaccination is postponed to a period three months later. The only other known distinctions between the two countries is that in Scotland only a minority of the cases are vaccinated by a public vaccinator, and that almost all the children are vaccinated at their own homes. 6, App. 631.

405. Since the 1st of June 1889 we have, from time to time, been informed from various sources of cases in which death or non-fatal injury has been alleged or suggested to have been caused by, or otherwise connected with vaccination with a view to their investigation, and since the 14th of February 1891 the Local Government Board have immediately informed us of all such cases brought to their notice. In March 1892 the Home Office addressed a circular letter to coroners throughout England and Wales, requesting that in all cases where they received information that the death of any person, on whose body they proposed to hold an inquest, had been alleged to have been caused by, or to have had any connexion with, vaccination they would communicate immediately with the Commission.

406. From all sources 421 cases in which death or non-fatal injury has been alleged or suggested to have been connected with vaccination, have been brought to our notice, from 1st June 1889 to 1st July 1896. These 421 cases, however, include 19 groups of connected cases, each of which has only been counted as one in arriving at that number. The individual cases included in these groups amount to about 150. Some of these 421 cases were investigated and made the subject of reports by medical inspectors of the Local Government Board. We received reports with reference to a large number of them from medical men appointed by ourselves. In a few cases the nature of the allegation or suggestion rendered it unnecessary in our opinion to make any inquiry into the case. In a considerable number we sought for further information, and after we had considered the further facts thus acquired there appeared to be no necessity for an investigation by the medical men who assisted us by personally inquiring into cases of alleged injury from vaccination. App. IX

407. We have not any means of ascertaining in what number of cases some other disease has supervened on vaccination as a consequence of it, without producing a fatal result. We are able, however, to form some judgment upon this point by observing the number of non-fatal cases to which our attention has been called. We do not mean to suggest that we have been informed of all cases of this nature which have occurred during the last six years. There have very likely been many cases which have not come to our knowledge, where the inflammation set up has been more than usual, and some where a slight attack of erysipelas has resulted. But when we consider that the fact that we were engaged upon this inquiry has been thoroughly well known, and that active organisations and zealous individuals were at work, searching out cases in which the results of vaccination had been abnormal, with a view to bring them under our notice, and that some of those which we were asked to investigate turned out to be of a trifling or unsubstantial nature, we think we are able to form a fairly accurate estimate of the amount of injury which can be plausibly attributed to vaccination. A consideration of all the circumstances has led us to the conclusion that, as regards the non-fatal cases with which we are now dealing, serious injury cannot have resulted in any considerable number of cases.

408. An examination of the analysis of the fatal maladies connected with vaccination during the period 1886 to 1891, made by Dr. Ogle, shows that erysipelas is credited with almost one-half of the total number of deaths. To these a considerable number is to be added, where inflamed arms occurred, but in which the disease did not receive the name of erysipelas, though it was probably allied to it. Next in number comes the class, which includes pyæmia, septicæmia, and blood poisoning. If this class be added to cases of erysipelas and maladies allied to it, they account altogether for two-thirds of the cases in which the cause of death has been connected with vaccination. An examination of the particulars of the cases of alleged deaths and injury from vaccination, to which our attention has been called during the last six years, shows that the death or injury has been attributed in the great majority of cases to one or other of these diseases, and chiefly to erysipelas. 6, App. 647.

409. It must not be forgotten that the introduction into the system of even a mild virus, however carefully performed, is necessarily attended by the production of local inflammation and of febrile illness. If these results did not in some measure follow, the practice would probably fail in its protective influence. As a rule, the inflammation and illness are of a trifling character; in exceptional cases, however, they may exhibit more severity, and, as certain facts submitted to us in evidence have shown, there are cases, though these are rare, where a general eruption may follow vaccination.

410. In order to determine how far the risk of erysipelas is a necessary incident of vaccination, what is the extent of that risk, and how it may best be avoided, it is necessary to consider the various circumstances which may occasion erysipelas and allied diseases in the case of vaccinated children. It is established that lymph contains organisms, and may contain those which under certain circumstances would be productive of erysipelas. It is, therefore, possible that some contagious material (the specific virus of erysipelas, for instance,) may be conveyed at the time of vaccination, owing either to its presence in the lymph employed, or to its being conveyed by the vaccinator himself, or by those with whom the child comes in contact at the time of vaccination. We believe that the cases in which the virus is conveyed at the time of vaccination are rare. It has, however, in some instances been clearly established, the immediate occurrence of erysipelas in several co-vaccinees making it practically certain that some virus was conveyed at the time of the operation. In some instances where this has been the case, and there is every reason for believing that the contagion was conveyed through the medium of the lymph, it is, nevertheless, in evidence that the vaccinifer did not display anything more than a slightly inflamed arm. The scrupulous avoidance of inflamed arms in vaccinifers will do much to reduce the risk of conveying erysipelas, in the act of vaccination (a risk which, as we have seen, has been proved to be a very slight one), but it is possible it would not wholly remove it.

411. Where the contagious matter which produces erysipelas or blood poisoning has not been conveyed at the time of vaccination the disease must have resulted, when it afterwards displays itself, from a subsequent introduction or development of the poison. It is not always easy to determine whether vaccination has been the cause of, or has contributed to, subsequent erysipelas or blood poisoning. Erysipelas is a common disease in infancy, and not unfrequently leads to death. The evidence of Dr. Ogle shows that nearly two thousand per million die of erysipelas during the first three months of life, and that the mortality rapidly declines as the age advances. Quite apart, then, from vaccination there is nothing remarkable in the occurrence of erysipelas in the case of an infant. The disease is obviously contracted in the majority of cases from some other source. Where a child has been in good health prior to vaccination and is seized with any malady after it, it is not unnatural that the two occurrences should be connected together as cause and effect by those who have not a wide experience of the liability to be attacked by the disease independently of vaccination. It is a common fault too readily to connect together, as cause and effect, occurrences which follow one another in point of time. There can be no doubt that this tendency has sometimes been the reason why, without any real connexion between the two, subsequent illness has been believed to have had its origin in vaccination. The apparent connexion of the two may be a mere chance coincidence. 6, App. 647.

Illustrations of this have not been wanting. It has sometimes happened that circumstances have led to the vaccination being, on the day appointed for the operation, postponed to a later date. A troublesome skin disease has shortly afterwards manifested itself, which would certainly have been believed to have been caused by the vaccination if it had taken place at the appointed time.

412. In many of the cases which we have had to investigate, where vaccination has been followed by erysipelas, the disease has been present in the immediate vicinity, it cannot therefore be asserted with certainty that in such cases the child would have escaped erysipelas if it had not been vaccinated. Erysipelas may be acquired without any lesion. We do not intend to represent that the wound made in vaccination may not cause an attack of erysipelas, where, if there were no lesion there would be no such attack, but only to suggest that caution is necessary, and that it would be an error to refer all cases of erysipelas, or allied diseases, occurring after vaccination to that operation as their cause.

There can be no doubt that even very slight wounds may lead to erysipelas. It has been induced by scratches from pins, abrasions from the dress and other injuries, in themselves most trivial.

413. We propose to call attention to some of the features which have been observed in the cases we have investigated where erysipelas has ensued upon, and in all probability been connected with, the act of vaccination. We have already said that in some of these cases, erysipelas was prevailing in the neighbourhood, and sometimes even in the immediate vicinity of the vaccinated child. In a considerable number it was reported that the condition of the premises in which the child was living was extremely insanitary. In some it was manifest that there had been a lack of care and attention on the part of the mother or other person in charge of the child. Not unfrequently the wound was in contact with and rubbed by articles of dress very likely to cause inflammation, and cream and other substances were applied to the wounds under circumstances which made the process a source of danger. There were instances in which persons in the habit of nursing a vaccinated child were suffering themselves at the time from running sores, which were very likely the source of contagion. In some cases, too, where the vaccinated vesicles had been opened on the eighth day, erysipelas manifested itself at a time which suggested that it had been acquired at a date subsequent to this opening of the vesicles. *A priori*, this would appear to be a source of danger by rendering an attack of erysipelas more probable if the child came within the reach of contagion. The evidence, however, is not conclusive that erysipelas has, owing to this cause, appeared more often than it would have done if the vesicles had remained unopened. There is an opinion abroad that the taking away of lymph on the eighth day of itself causes some risk of inflammation of the arm. This, however, has not been confirmed by any evidence before us, and it is probable that it is almost wholly an imaginary danger.

414. We have dwelt upon features presented by the cases of erysipelas and various forms of septic disease which have followed vaccination, because they suggest precautions which may be adopted to lessen, if not to prevent, such evils in the future. If, for example, vaccination were performed at the patient's home instead of at a public vaccination place the chance of disease being contracted at the time of vaccination would be to some extent diminished, and the same may be said of the inspection of the vaccinated person which takes place eight days after the operation. On these points we shall have some remarks and recommendations to make at a later stage of our report.

415. A study of the cases which have been made the subject of careful examination and report points to the conclusion that an exercise of greater care would largely diminish the risk, already small, of erysipelas-contagion and blood-poisoning.

Although it may be confidently hoped that by additional care on the part both of vaccinators and parents, the number of inflamed arms and of cases of erysipelas may be reduced to very few, yet it is not to be expected that such occurrences will be wholly prevented. A vaccination wound is like one from any other cause, so long as it exists, a source of some risk.

416. The use of calf-lymph, though it may be supposed to be more free from the risk of conveying erysipelas, does not appear to prevent inflamed arms. Some witnesses have indeed supposed that it is attended with more risk of inflammation than the employment of that taken from the human subject. This opinion has not, however, been corroborated by some of those of widest experience.

417. The evidence given in reference to cases in which one or other of the maladies classed as scrofula has been supposed to have had its origin in vaccination, has usually been of a very vague and inconclusive character. Scrofula is a disease chiefly of childhood, and, being very common, there is nothing to cause surprise in the fact that occasionally children may show its presence in a manner likely to excite suspicion that it was due to vaccination. It may, indeed, easily be the fact that vaccination, in common with chicken-pox, measles, small-pox, and other specific fevers, does occasionally serve as an exciting cause of a scrofulous outbreak. It may, however, not unreasonably be suspected that in all such cases a latent predisposition was already present. The chain of causation is so complicated that it is impossible in isolated cases to arrive at any satisfactory conclusions. To attempt any analysis of the evidence on this subject comprised in Appendix IX. and the various Reports which we have already issued would serve no useful purpose. It must be sufficient to say that after careful consideration of the whole evidence there appears to be no reason whatever to believe that the practice of vaccination tends in any material degree to increase the prevalence of this class of disorders.

418. Precisely the same arguments as those just used are applicable to the chronic skin diseases, chiefly of the type of eczema, which are so often, by the public, attributed to vaccination. Of these numerous supposed instances have been brought before us and the medical men whose assistance we have had. It is to be freely admitted that vaccinia, like varicella, does occasionally cause an irritable condition of the skin which may last long, but it is exceedingly improbable that it is responsible for any substantial increase in the number of chronic skin diseases in children. No sufficient evidence whatever in support of such a conclusion has been brought before us.

Amongst the inconveniences connected with vaccination is the production of contagious forms of eruption, such as have been classed under the names of porrigo and impetigo contagiosa. These eruptions are not attended with any risk to life, nor by any permanent injury to health, and they are usually curable by simple measures. References to these eruptions have been made by many witnesses. Their occurrence has no doubt not unfrequently caused prejudice to the practice of vaccination.

419. As has been already stated, the occurrence of a febrile illness is the desired result of vaccination. To that illness the term vaccinia is applicable, and it may sometimes be attended by an eruption. It is in evidence that vaccinators in the early years after the introduction of the practice, were familiar, not only with severely inflamed arms, but with the frequent occurrence of general eruptions. Familiar as they were with the horrors of small-pox itself, they thought very lightly of events which in the present day would cause much complaint and excite opposition. The greater care now exercised in vaccination, and possibly, above all, the much diminished risk of variolation at the same time, have reduced to a very small number indeed the occurrences referred to. Still it has not been found possible wholly to prevent them, and not only do vaccinators still meet occasionally with inflamed arms and erysipelas, but now and then a case occurs of severe eruption attended by fever, which may end in death. These cases occur exclusively in primary vaccinations and in young infants. They are so infrequent that no well-characterised examples have been brought under the notice of the medical men who have assisted us. A few which had occurred in former years have, however, been the subjects of evidence. These cases may be placed in two groups, one in which the vaccination sores proceed normally, but a general eruption, possibly gangrenous, occurs, and a second in which the pocks inflame, and are attended by satellites, and a more limited eruption, possibly due only to external contagion, is produced. Of the first, only a single example is to be found in the reports (Case 31: not fatal) before us, but of the second there have been several. One of the most definite of these latter is the case ably and fully reported in the evidence of Dr. Fyson and Dr. Frederick Taylor. In that instance a child previously in good health, and vaccinated with calf-lymph by means of a needle which had never been used before, died about six weeks afterwards with severely ulcerated arms, and ulcers in several parts of the body and limbs. No precaution had been neglected, and the event could only, as in other similar cases, be attributed to what is known as idiosyncrasy on the part of the child, a peculiarity of health attended by exceptional susceptibility to the specific virus of vaccinia. Q. 23,019–61; 23,062–83.

Cases more or less closely parallel with this one are the Leeds case and one mentioned in the evidence given by Dr. W. G. Little. Q. 20,894, et seq.

420. Nothing has produced so deep an impression hostile to vaccination as the apprehension that syphilis may be communicated by it. It was at one time doubted whether syphilis could result, and it was even confidentially asserted that it could not. The fact that this was possible had been fully established, and was generally acknowledged by the medical profession before we commenced our inquiries. Our work has therefore chiefly been to ascertain the extent and character of the risk and the means of its prevention. As a general summary of the evidence on this matter, it may be stated that nothing in the least novel has been elicited, and that no hint has been given of the occurrence of any recent *series* of vaccination-syphilis cases in British practice.

421. In 1856, an extensive investigation undertaken by the Board of Health, under the direction of its Medical Adviser, resulted in the expression of an opinion that there was no proof that syphilis could be communicated in the practice of vaccination. Mr. Simon had issued circular letters of enquiry very widely, and although a few of his respondents had answered cautiously, none had been able to produce convincing facts, and a large majority had expressed entire incredulity. Amongst the latter were Sir Thomas Watson, Sir Charles Locock, Sir Benjamin Brodie, Mr. Acton, Mr. Marson, Mr. Ceely and Sir William Jenner. Facts which were, not long after the issue of Mr. Simon's report, brought before the profession, and which were carefully investigated, made it certain that the negative conclusion which had been arrived at was a mistaken one, and from that time no doubt can have been entertained by any that it is possible to convey syphilis in the act of vaccination. In reference to the frequency of this, the report just referred to is still, however, of high importance. It is impossible to believe that an event concerning the possibility of which almost all the leaders of the profession were in 1856 incredulous can be otherwise than extremely rare.

422. Before proceeding to speak of the facts, or supposed facts, as to syphilis due to vaccination, which have been brought before the Commission, it is necessary to advert to the difficulties of the inquiry. The phenomena of syphilis may be closely approached by those of other disorders, and even when the nature of the malady is evident beyond doubt, there remain numerous sources of fallacy which have to be cleared away before the conclusion can be accepted that the disease has been caused by vaccination.

423. The very close resemblance in certain very rare cases of the results of vaccination, whether with calf-lymph or humanized lymph, to those attributed to syphilis (a resemblance so close that it has caused in a few cases a difference of opinion whether the disease was syphilis or vaccinia) has led to the expression by Dr. Creighton of the opinion that there is some essential relationship between the two diseases. This, however, is a point of speculative, almost it might be said of transcendental pathology, upon which for practical purposes it is useless to enter. It must be sufficient to remark that, whatever may be the relationship alluded to, it exists, if it exists at all, equally between small-pox and syphilis as between vaccination and syphilis. For all practical purposes variola and vaccinia are both wholly distinct from syphilis, and their differences are, with the rarest exceptions, easily recognised. They are alike in being attended by affections of the skin and mucous membranes, and exceptionally by disease of the bones, eyes, and other parts, but in all these it is a question of resemblance and not of identity with which we have to deal.

424. The knowledge of the sources of fallacy just alluded to has compelled the Commission to investigate with much caution the items of evidence which have been offered by the various witnesses whom it has examined. Some of these have manifested a tendency to recognise syphilis after vaccination upon very imperfect and insufficient data.

It is very desirable that every narrative of supposed infection with syphilis in the course of vaccination should be given in full detail. The dates should be accurately fixed, there should be an account of the vaccinifer and of those, if any, who were vaccinated at the same time. It is important too that the statements made should be based upon notes recorded at the time. Narratives which are defective on these points, although they must be taken for what they are worth, cannot ever be accepted as proven. When a witness admits that in so important a matter he took no care to ascertain such facts as those referred to, that his diagnosis was made without consultation with others, and that his statements rest only on his unassisted memory, it becomes impossible to allow them much weight. Yet such is the character of much of the evidence which has been offered to the Commission on this question.

The cases mentioned by Mr. Ward, of Leeds, in the course of his evidence as recorded at page 218 of the Sixth Report, are the most serious ones as regards this matter which have been brought before the Commission. There can be no doubt that in the case observed by Mr. Ward himself, the disease was syphilis and the chief defect in the narrative is as to proof that it was acquired in vaccination. No information was obtained as to the vaccinifer or the co-vaccinees, and the patient being an adult woman other modes of infection were obviously possible. At the same time it is right to add that the points of vaccination became indurated, and that Mr. Ward was convinced that it was a case of invaccinated syphilis. In the cases referred to by Mr. Ward as having occurred (in 1871) in the practice of Mr. Holmes of Leeds, inquiries subsequently instituted by the Commission have left no doubt that syphilis was conveyed to two (out of six) individuals by vaccination, one of whom died in 1886, it is believed, of syphilis. The vaccinifer was at the time the subject of latent taint, and this was revealed very shortly after the vaccination. These cases, it will be seen, occurred 25 years ago, and before the attention of the profession had been directed to this risk so prominently as has since been done.

App. IX.

Q. 27,254–62.

425. Among the 279 deaths referred to vaccination as a cause during the period 1886–1891, five were attributed to syphilis. Except in cases where an inquest was held, these records are based simply on the certificate given by the medical attendant who certified the cause of death, but who had not necessarily attended the patient during the course of the illness which terminated fatally. Practically all the deaths referred to vaccination as a cause during the years 1889, 1890, and 1891, and some of those so referred during the last two months of the year 1888, have been investigated and reported upon by Medical Inspectors of the Local Government Board. It appears that all the five cases attributed to syphilis after vaccination, during the longer period 1886–1891, were among the cases so reported upon. We have studied these reports and we are satisfied that in none of the five* cases is there sufficient evidence to show that the death resulted from syphilis caused by vaccination. One of them was the Leeds case,† to which we shall refer immediately. As regards the others, with perhaps one exception,‡ there is abundant reason for believing that they were not cases of syphilis at all.

[* *i.e.*, Cases XLVI., XLVIII., XLIX., XC., and CXLVII. of the Local Government Board series.]

[† Case XC.]

[‡ Case XLVI.]

But besides these five deaths, there were amongst those alleged or suggested to have been connected with vaccination, which were investigated and reported upon by Medical Inspectors of the Local Government Board, eight§ cases in which in the course of the investigation some suspicion of syphilis was raised in connexion with the illness which terminated fatally. In none of these eight cases, however, is there evidence of any value to show that syphilis was communicated by vaccination.

[§ *i.e.*, Cases XLV., XLVII., LXXII., CXXVII., CXXIX., CLXXI., CLXXXI. and CXCVI.]

426. Two or three other isolated cases have been brought to our notice which witnesses believed to be examples of this occurrence, but in none of them were the facts such as in our opinion to justify us in concluding with any degree of confidence that the belief expressed had been sustained. On the other hand, a large amount of negative evidence has been offered. Witnesses who had been engaged through long series of years in the very extensive practice of vaccination, bore testimony to their never in their own sphere of observation having witnessed or heard of any case in which the suspicion of vaccination-syphilis had occurred.

At the same time it is not to be forgotten that a natural reluctance to register deaths as due to syphilis may have prevented some cases where recently vaccinated persons have died from that disease from being made public.

Q. 23,574–746; 23,747–858; 23,859–912.

App. IX., reports on Case i.

427. Only a few items of the evidence produced before us appear to require special notice: among these, the most prominent is what has been known as the "Leeds case," upon which we have heard the evidence of Mr. Ward, Mr. Littlewood and Dr. Barrs. The witnesses named regarded it as a case of syphilis, conveyed by vaccination, but all of them admitted that the course of events was most unusual. We have carefully investigated this case, and notwithstanding the opinion formed by the witnesses, there appears good reason to doubt whether it was one of syphilis. The case was made the subject of careful inquiry by Dr. Barlow on our behalf, who shared the doubt we have expressed. The view taken by the Medical Inspector of the Local Government Board who in the first instance investigated the case was that it was a case of hereditary syphilis. It seems certain, however, that the parents of the child whose death was in question were not in any way affected with syphilis. The

vaccinifer also appeared to be free from any taint of that disease, and its family history confirmed this view. The co-vaccinees from the same lymph also exhibited no trace of syphilis. These facts of themselves make out a strong case against that having been the nature of the disease. Coupled with the fact that it could not have been communicated by the vaccinator himself, they seem to render it practically impossible that syphilis was the cause of death. If the symptoms exhibited had in all respects corresponded with those which are known to characterise syphilis, the proper inference might have been that there was some error in ascertaining the facts of the case. But it is beyond question that the course of events was very different in some respects from that experienced in undoubted cases of syphilis, and we think the true conclusion is that it was not a case of that disease. It may probably be classed with a few others as examples of gangrene and blood poisoning, the direct result of vaccination, which are not to be explained by supposing the introduction of any syphilitic or other poison. Fortunately, such cases are extremely rare, so much so that the witnesses concerned knew of no case precisely parallel.

428. The evidence given by Dr. Robert Lee and Dr. Coutts, the former, physician of the Ormond Street Hospital for Children, and the latter, formerly a resident medical officer to the same institution, may be taken as relating to one and the same case. Both these witnesses testify to the abundant occurrence of the ordinary forms of congenital syphilis in the practice of that institution. Each of them mentions one single case in which it was believed that syphilis was communicated in vaccination and that the vaccination-sore became a chancre. Although it is not established in evidence that these witnesses were speaking of the same case, it is almost certain that they were, as Dr. Coutts expressly states that the child was Dr. Lee's patient. Neither of the witnesses knew more of the case than its earliest stages, and both were subjected to questions the answers to which left much doubt as to the correctness of the diagnosis. Whilst, however, syphilis cannot by any means be said to have been proved, the case must stand as one of reasonable suspicion, and Dr. Coutts' statement that another infant (not seen) vaccinated from the same source was said to have suffered in a similar way gives some support to Dr. Lee's opinion. It is of much importance to note that out of an experience of 30,000 children, at an institution beyond all others likely to attract cases of this kind, this was the only example of supposed transmission of syphilis in vaccination which Dr. Lee had ever known.

Q. 30,238–560; 30,632–731.

429. In considering those cases specially investigated by medical men on our behalf, we have as a rule the advantage of definite and adequate information. We have already mentioned that in the Leeds case,* upon which we heard evidence, we had the benefit of Dr. Barlow's assistance; and we need not further discuss that case. Amongst the others investigated by medical men on our behalf were two† cases in which death was apparently certified as from vaccino-syphilis. The first‡ of these two deaths was registered, in 1892, as due to "vaccinia syphilitica; marasmus," but it subsequently appeared that the medical man who certified the death had not intended to state that it resulted from syphilis caused by vaccination. In explanation of his certificate, he said: " . . . . the meaning I intended to convey was 'vaccinia,' *i.e.*, a general " eruption over the body exactly like the vaccination pocks occurring in an infant the " subject of congenital syphilis"; and a careful inquiry by Dr. Acland elicited overwhelming evidence in support of the view that the case was one of inherited syphilis. The second§ of the two deaths was registered, in the present year, as due to "vaccination of syphilis." A thorough investigation showed that the case was certainly not one of syphilis caused by vaccination, and in all probability not one of syphilis at all.

[* Case 1 of the Commission's series and Case XC. of the Local Government Board's series.]

[† *i.e.*, Cases 109 and 416 of the Commission's series.]

[‡ Case 109.]

[§ Case 416.]

Two|| other cases, both fatal, were reported to us in which children whose vaccination had undoubtedly been followed by serious illness were believed to have been subjects of inherited syphilis. Both cases were very carefully investigated by Dr. Acland on our behalf. In neither of them is there any evidence that syphilis was communicated by vaccination. Probably both children were, as at first surmised, subjects of inherited syphilis.

[|| *i.e.*, Cases 207 and 326.]

Besides these deaths, there were amongst those alleged or suggested to have been connected with vaccination, which were investigated and reported upon by medical men on our behalf, ten¶ cases in which in the course of the investigation some suspicion of syphilis was raised in connexion with the illness which terminated fatally. In none of these ten cases, however, is there evidence of any value to show that syphilis was communicated by vaccination; possibly five** of them were cases of inherited syphilis. The other five†† were certainly not cases of syphilis at all.

[¶ *i.e.*. Cases 52, 94, 113, 192, 195, 202, 215, 216, 309, and L.E.J. in Case227 [series]

[** Cases 195, 202, 215, 309, and L.E.J. in Case 227 [series].]

[†† Cases 52, 94, 113, 192, and 216.]

Turning now to the *non-fatal* cases investigated by medical men on our behalf, we have had brought to our knowledge with a view to such investigation 26‡ non-fatal cases where syphilis was alleged to have been, or as to some few of the cases *possibly* to have been, communicated by vaccination. One§ of these 26 cases could not be traced by the medical men whom we asked to investigate it. It had been reported to us, with 21 of the other 25 cases, by a gentleman whose only information as to the case, obtained from a relative of the child's, was that "the child had a frightful arm, "and broke out badly everywhere, and was a very long time of getting better." The remaining 25 cases were, however, carefully investigated on our behalf, some by Dr. Barlow, some by Dr. Acland, and 15 of them by those gentlemen jointly. In 24 of the 25 there is no evidence that syphilis was communicated by vaccination; indeed, none of the 24 were cases of syphilis at all. In the remaining case|| it appears that there was some ground for the allegation, though it is by no means proved that syphilis was communicated by vaccination, or even that the case was one of syphilis at all. The case, brought to our notice in 1892, was that of a boy born in 1880 and vaccinated in the following year. When examined on our behalf in September 1892 he presented no unmistakable signs of having suffered from syphilis, either inoculated or inherited. The length of time which had elapsed, and the absence of any record, made it impossible to trace the source of lymph. The history of the boy's illness is extremely uncertain, but upon the whole, if it can be relied upon at all, it tends to render some support to the view that syphilis was communicated by vaccination or by contamination of the vaccination wounds.

[‡ *i.e.* Cases 12 and 13; E.M.S. in Case 21 [series]; the following in Case 139 [series], A.E.L. (No. 426 in the vaccination register), A.L.C. (No. 406), J.E. (No. 409), W.E.W. (No. 424), J.P.F. (No. 429), F.M.D. (No. 440), N.G.S. (No. 449), A.F. (No. 451), F.J. (No. 453), H.L. (No. 455), E.J.S. (No. 456), F.R. (No. 458), E.J. (No. 459), A.J.L.C. (No. 467), M.M. (No. 469), and L.H. (No. 484); Cases 141, 142, 143, 144, 145, 146, and 180.]

[§ In Case 139 [series], namely, A.F., No. 451 in the vaccination register.]

[|| Case 141.]

Besides the non-fatal cases to which we have just referred, there were amongst those investigated by medical men on our behalf, in which non-fatal injury had been alleged or suggested to have been caused by vaccination, 13¶ cases in which in the course of the investigation some suspicion of syphilis was raised in connexion with the illness which followed vaccination. In none of these 13 cases, however, is there evidence of any value to show that syphilis was communicated by vaccination; one** was a case of inherited syphilis, and the other 12 were not cases of syphilis at all.

[¶ *i.e.* Cases 11, 102, 128 and 129; the following in Case 140 [series], M.W. (No. 6 of series), C.C. (No. 23), J.H. (No. 24), A.N. (No. 25), A.J.A. (No. 64), and W.B. (No. 69); Cases 175 and 187; and C.M.J. in Case 227 [series].]

[** C.M.J. in Case 227 [series].]

430. The evidence offered to us would lead to the belief that whilst with ordinary care the risk of communication of syphilis in the practice of arm-to-arm vaccination can for the most part be avoided, no degree of caution can confer an absolute security. The rejection as vaccinifers of young infants, say below four months of age (in whom congenital syphilis may be as yet undeclared), and of adults (in whom the disease may possibly have been recently acquired) are precautions which would probably shut out almost the whole of the risk. The outbreaks of syphilis in connexion with vaccination which have been mentioned to the Commission (all of which had been previously published) have occurred chiefly in arm-to-arm vaccination amongst soldiers, or from the use as vaccinifers of young infants the offspring of parents whose history was not known to the vaccinator. It must, however, be admitted that neither the examination of the vaccinifer if taken alone, and without a knowledge also of the parents, nor the most scrupulous avoidance of any visible admixture of blood with the lymph, are in themselves, however valuable, sufficient absolutely to exclude risk. The evidence given by Dr. Husband, of the Vaccine Institution of Edinburgh, established the fact that all lymph, however pellucid, does really contain blood cells. Absolute freedom from risk of syphilis can be had only when calf-lymph is used, though where the antecedents of the vaccinifer are fully ascertained, and due care is used, the risk may for practical purposes be regarded as absent.

Q. 27,327–9.

431. As regards the possible effect of vaccination in increasing the prevalence of leprosy, no affirmative evidence has been brought before the Commission which in their opinion establishes that this effect has resulted from the practice. On the other hand, much of a strongly negative character has been produced. The evidence which has been supposed to give support to the suspicion that leprosy has been caused by vaccination is of two kinds. First, the recent increase of leprosy in certain districts simultaneously with an increase of vaccination, and secondly, the assertion that in isolated cases leprosy has really followed the practice of vaccination. In regard to the former of these supposed arguments, it has been shown in evidence that there has been no general relationship between the increase of vaccination and the increase of leprosy. Whilst in a few places, of which the Sandwich Islands offer by far the most definite example, leprosy has very largely increased during vaccination periods; in others, New Zealand, for instance, it has died out, and in others, such as Norway, Iceland, and India, it has probably undergone decline. The evidence of Dr. Beaven Rake, a gentleman of great experience of leprosy as it occurs in the West Indian Islands

and a member of the Commission recently sent out to report on the causes of leprosy in India, was definitely opposed to the belief that vaccination had any share in its spread. As regards the allegation that in certain individual cases vaccination had produced leprosy, there is no conclusive evidence.

The supposed risk of conveying leprosy in vaccination may be wholly got rid of by using English lymph or that from the calf.

432. As regards the almost infinitesimal risk of syphilis, it must be admitted that re-vaccination cases stand in the same position as primary ones. In reference to other dangers, however, the risk is even less in the case of adults than we have indicated it to be in the case of infants. This is a fact of great importance when the necessity for re-vaccination to which we have already directed attention is remembered.

433. It is obvious that the employment of calf-lymph only would wholly exclude the risks as regards both syphilis and leprosy. Respecting the latter disease, however, there appears to be reason to doubt whether any risk exists, and at any rate it does not concern the British population. Even in leprosy districts the employment of English human lymph would be, so far as leprosy is concerned, as safe as that from the calf. The risk of syphilis, although real, is an exceedingly small one, even when humanized lymph is employed, and may probably be wholly avoided by care in the selection of the vaccinifer. As regards all the other dangers, whether of severe illness or temporary inconvenience, the two forms of lymph appear to stand on the same level. The instances of inflamed arms, of erysipelas, of vaccinia maligna, and eczematous eruptions are not more common after the use of human lymph than after that from the calf. Some of the best qualified witnesses who have afforded us their assistance have expressed a deliberate preference for arm-to-arm vaccination, believing that the advantages of calf-lymph are more imaginary than real.

434. A careful examination of the facts which have been brought under our notice has enabled us to arrive at the conclusion that, although some of the dangers said to attend vaccination are undoubtedly real and not inconsiderable in gross amount, yet when considered in relation to the extent of vaccination work done they are insignificant. There is reason further to believe that they are diminishing under the better precautions of the present day, and with the addition of the further precautions which experience suggests will do so still more in the future.

(C.) *As to whether any, and, if so, what means should be adopted for preventing or lessening the ill effects, if any, resulting from vaccination; and whether, and, if so, by what means, vaccination with animal vaccine should be further facilitated as a part of public vaccination.*

435. We are asked further to inquire and report whether any, and, if so, what means should be adopted for preventing or lessening the ill effects, if any, resulting from vaccination, and whether, and, if so, by what means, vaccination with animal vaccine should be further facilitated as a part of public vaccination.

436. We have already, in connexion with a discussion of the nature and extent of any injurious effects which result from vaccination, indicated some means which might be adopted for preventing or lessening those ill effects. It will be well, however, even though it may involve some repetition to deal with them all together in this section of our Report.

437. We put the use of calf-lymph in the forefront because, as we have said, this would afford an absolute security against the communication of syphilis. Though we believe the risk of such communication to be extremely small where humanized lymph is employed, we cannot but recognise the fact that however slight the risk, the idea of encountering even such a risk is naturally regarded by a parent with abhorrence. We think, therefore, that parents should not be required to submit their children to vaccination by means of any but calf-lymph, but this should not preclude the use of humanized lymph in case they so desire.

So long as the State, with a view to the public interest, compels the vaccination of children, so long even as it employs public money in promoting and encouraging the practice, we think it is under an obligation to provide that the means of obtaining calf-lymph for the purpose of vaccination should be within the reach of all. We have no hesitation, therefore, in recommending that steps should be taken to secure this result. Whether the duty of providing calf-lymph should be undertaken by the Local Government Boards in the several parts of the United Kingdom, or whether some other method would be more advantageous, can be better determined by those who have had practical acquaintance with the working of the vaccination laws.

438. We have already noticed that whilst in Scotland the age within which vaccination is obligatory is six months from the date of birth, in England and Wales and in Ireland it is three months from that date. There is obviously no good reason for this want of uniformity. We have come to the conclusion that it would be well, at all events, to extend the age period in England and Wales and in Ireland to six months from the date of birth.

It is difficult to judge how far untoward incidents of vaccination would be likely to be lessened if the operation were postponed to a later age than three months. Looking at the circumstance that the tenure of life in children of a very early age is frail, and that where a disease supervenes upon vaccination the ability to battle against it may determine whether the result is fatal or not, or to what degree injurious, we should *a priori* think that the chances of death or injury from such a cause would be less, looking at the matter as a whole, when the age of the child was more advanced.

The evidence in our possession bearing upon the point is very slight. It consists only of the fact, to which we have called attention, that the return of deaths connected with vaccination in Scotland shows a much smaller proportion in comparison with the number of children vaccinated than in England. We have pointed out that there may be other explanations of this phenomenon, but so far as it goes it lends some support to the *a priori* view we have indicated.

We are aware that one consideration which led to the reduction of the period in Ireland to three months was that it would lessen the difficulty of tracing defaulters due to removals. But the experience of Scotland seems to show that the difference in this respect, whether the longer or shorter period be adopted, is not very grave.

439. We are quite alive to the objections which may be urged against a prolongation of the period within which vaccination must be performed. It will naturally be said that a number of children, who otherwise would be protected against small-pox, would be left without that protection, and would thus be liable to suffer from the disease themselves, and be a source of danger to others. It must be remembered, however, that so long as children cannot walk, the risk of their contracting contagion is less than if they were able to move freely about and mix with other people, and that, for the same reason, the risk of their communicating contagion to others is less. We cannot trace in the statistics relating to Scotland any grounds for believing that the later compulsory vaccination age which prevails in that country as compared with England has affected, to any substantial extent, the general small-pox mortality of Scotland, though no doubt it may have led to some deaths among children under six months of age which otherwise would not have taken place.

We have already shown how satisfactory a position Germany has occupied in relation to small-pox since the year 1874. The age of compulsion in that country is the end of the next calendar year after birth. It is true that re-vaccination has been there made compulsory as well as primary vaccination, but we think the experience of Germany is not without its bearing on the question we are now considering. Wherever the line is drawn, whether at three months or six months, it will always leave a class of unvaccinated persons. The age to be fixed is a question of policy into which many considerations must enter. If an extension of the age within which vaccination was required rendered its untoward incidents fewer in number, and diminished hostility to the operation, it may be that on the whole it would promote the cause of vaccination, and secure, as its result, that the number of vaccinated persons would be greater than at present.

440. The truth is that it is only when an epidemic breaks out in any place that the vaccination of very young children becomes a question of grave importance. An epidemic is not likely to originate, nor in its early days to grow, owing to the non-vaccination of that class.

If, then, security could be obtained that whenever a case of small-pox occurred in a sanitary district, children within the range of the present compulsory law should be vaccinated, we think the protection against small-pox would not be substantially less than it is at present. Without some such provision as this, we should not be prepared to recommend an extension of the age beyond the period allowed in Scotland. With such a provision, we think that the age might be advantageously extended to one year from the date of birth, and that the number of cases in which death was, whether correctly or not, attributed to vaccination would then much diminish. A provision of this kind would, however, no doubt, involve some practical difficulties.

441. Our attention has been called to the fact that in some workhouse infirmaries and lying-in hospitals it has been the practice to vaccinate children within a few days of their birth. Although under favourable conditions vaccination may be successfully carried out at that early age, we think the practice is to be deprecated unless there be at the time obvious danger of small-pox contagion. In the exceptional cases in which vaccination becomes, on that account, necessary, the infant should, if possible, be kept under observation until the arm is healed. And we think that, in these cases, it is very undesirable to vaccinate in four or five places; the operation should be limited to a single insertion of the vaccine matter.

442. A study of the reports in our possession relating to cases in which erysipelas or septic disease has followed vaccination teaches no lessons more forcibly than these—that any abrasion of the vaccination vesicles by clothing of a nature likely to irritate them should be avoided, and that foreign substances should not be rubbed into the wounds under circumstances calculated to set up inflammation. It is most important, too, that any rags or other materials applied to the place of vaccination should be scrupulously clean. The want of care in these respects on the part of the parent or person in charge of the child has frequently been a source of mischief. If more care were exercised much good would result. Parents and others in charge of children are frequently unaware of the importance of these matters, and of the evil which may follow from a disregard of them. We think it would be well that a warning on the subject should be addressed to such persons. It has been the practice of some public vaccinators to take this course. It is desirable that the practice should be universal, and that the Local Government Board should settle a suitable form containing clear and simple rules for guidance in the care of the vaccinated arm, and for the avoidance of any likely source of injury or irritation of that part. If this were done untoward incidents might, we think, be largely diminished.

443. We have already drawn attention to the fact that some cases of disease contracted through vaccination might be avoided if the operation were performed at the child's home, instead of at a public vaccination station. At present the child has not unfrequently to be taken twice to a considerable distance, first for the operation itself, and then for the subsequent inspection. This sometimes involves exposure to inclement weather which is of itself, hazardous. Besides this a considerable number of children are often collected both on the occasion of the vaccination and of the inspection, and the risk of contagion is thereby increased. If children were vaccinated and inspected, as a rule, at their own homes, instead of being brought to a public station, we believe the risk of injury would be sensibly lessened.

444. A medical man attending at the child's residence would be better able than the public vaccinator ordinarily can be to judge whether circumstances made it expedient to postpone vaccination for a time.

The insanitary conditions in which a child was living have often afforded an explanation of septic diseases which have supervened on vaccination. These conditions would be better known by a medical man visiting the home than by a public vaccinator to whose station a child is brought.

445. There can be no doubt that vaccination ought to be postponed when erysipelas, scarlet fever, measles, or chicken-pox are prevalent in the neighbourhood of the child's residence, or, if the child is not to be vaccinated at home, either there or near the place of vaccination. Here again there would be a gain if the home was more often the place of vaccination.

446. It would, in our opinion, be an advantage if the postponement of vaccination, were expressly permitted, not only on account of the state of the child, but of its surroundings and any other conditions rendering the operation at the time undesirable. If more discretion in this respect were possessed and exercised, we think untoward results would become even rarer than they are.

If provision could be made in cases in which insanitary conditions would cause risk to a child, if it remained at home whilst the vaccination wound was unhealed, for its removal elsewhere during that period, we think it would be desirable.

447. We think that the vaccination vesicles should not be opened unless for some adequate reason. We have already said that in our opinion the importance of this has been exaggerated, but the precaution is nevertheless a wise one, and may be of use.

448. We think that safety would be increased by preserving the lymph in tubes instead of on "dry points." There is some difference of opinion on this matter amongst those with whose opinions we have been furnished. On the whole, however, we think the weight of experience as well as reason is in the direction we have indicated.

In connexion with this subject, our attention has been drawn to the experiments recently made by Dr. Copeman as to the effect of the storage of vaccine lymph in glycerine. The conclusions at which he arrives are that the addition of glycerine, whilst it leaves the efficacy of the lymph undiminished or even increases it, tends to destroy other organisms. If it be the fact that the efficacy of the lymph remains unimpaired, its storage in glycerine would largely diminish the difficulties connected with the use of calf-lymph, which are inseparable from calf to arm vaccination. The investigation has not yet reached a point at which it is possible to pronounce with certainty whether the anticipated results would be obtained. And it was at one time suggested that the introduction of glycerine was likely to be mischievous. The question is one a further investigation of which is obviously desirable.

If lymph is to be preserved in glycerine, due care would be requisite to ensure its purity and the absence of contamination in its introduction. We think that, whether mixed with glycerine or not, each tube should contain only sufficient lymph for the vaccination of one person.

449. Another precaution which ought to be insisted on is that no instrument should be used for the operation which has not been boiled or otherwise sterilised for the purpose; and the simpler the instrument employed the better.

Care should be exercised, too, not to place the insertions too near together, so as to injure the vitality of the tissues between them.

450. We think the time at present fixed for inspection of the vaccinated arm is somewhat too early, and that some time during the second week after vaccination should be substituted for the eighth day; and, moreover, that another inspection should be obligatory in the third week after vaccination. If summoned by the parent on account of any unfavourable symptoms prior to the time fixed for inspection, the vaccinator should be bound to attend, and notice should be given to parents of their right thus to summon the public vaccinator.

The amount of the fee to be received by the vaccinator would, of course, require to be determined with reference to the duties which it is proposed to impose upon him. We think the fee should be adequate to cover all these duties.

In any case where a child requires medical attendance owing to illness supervening on vaccination, we think it should be the duty of the vaccinator to render such attendance if required by the parent, and that he should receive a fee in respect thereof.

In our opinion, if the precautions we have suggested were adopted, untoward incidents of vaccination, already rare, would become much rarer.

(D.) *As to what means, other than vaccination, can be used for diminishing the prevalence of small-pox; and how far such means could be relied on in place of vaccination.*

451. Another question upon which we are asked to report is, what means, other than vaccination, can be used for diminishing the prevalence of small-pox; and how far such means could be relied on in place of vaccination.

452. The means other than the inoculation of small-pox or cow-pox, which have been referred to by witnesses as being capable of diminishing the prevalence of small-pox, are such means as have been employed against infectious diseases generally; they may be summarised as—1. Measures directed against infection, *e.g.*, prompt notifica-

tion, isolation of the infected, disinfection, &c. 2. Measures calculated to promote the public health, the prevention of overcrowding in dwellings or on areas, cleanliness, the removal of definite insanitary conditions, &c.

The principle underlying the practice of isolation with its accompanying machinery is obviously the very opposite of that which recommended the practice of inoculation; it aims at exclusion of the disease, whereas inoculation aimed at universal acceptance by artificially "sowing" or "buying" the disease. Except in regard to the plague our knowledge and practice of measures of isolation and quarantine against epidemics is of relatively recent growth. As the result of increased knowledge of the mode of propagation of infectious diseases, of greater sanitary activity, and under the stimulus of legislation, organised effort, more or less thorough, is now, in this as in other countries, directed against the spread of dangerous infectious diseases. Side by side with a vaccination system, means of isolation, &c., have been successfully employed to check the spread of small-pox. They have also been sometimes so employed in recent years in places where vaccination has fallen into disuse.

453. It will be well to commence with a brief statement of the growth of our knowledge on the subject of isolation as a means of dealing with infectious or contagious diseases. We have already adverted to the fact that small-pox is highly contagious, and that contagion from those suffering from it is the means by which the disease is propagated.

454. Although reference to infection appears in some of the Arabian writers, the contagiousness of small-pox attracted little attention in this country and in Western Europe until the 18th century. Sydenham (1624–1689) though he refers to the contagiousness of small-pox, did not dwell upon the matter and did not regard it as so important an element in the spread of the disease as some peculiar constitution of the atmosphere to which he attributed epidemics. Boerhaave was the first at the commencement of the 18th century distinctly to formulate the now generally accepted doctrine that small-pox arises only from contagion.

455. In 1720, Mead drew up an elaborate system of notification, isolation, disinfection, &c. in view of a threatened invasion of the plague, but no attempt to deal with small-pox in a similar fashion appears to have been made until the last quarter of the 18th century. This was in all probability largely due to the adoption of inoculation as the recognised defence against small-pox, and the acceptance of Sydenham's doctrine of epidemic causation may have exercised an influence in the same direction.

456. No writer appears to have suggested methods of isolation, disinfection, &c. against small-pox prior to 1763. In that year Rast of Lyons published his Reflections on Inoculation and Small-pox, and upon the means which might be taken to deliver Europe from that malady. He maintained—1. That small-pox was not a necessary and inevitable malady. 2. That it arose only from contagion. 3. That it resembled plague in most of its features. His conclusion was expressed in these terms: "I say, that to "deliver Europe from small-pox we must act upon principles directly opposed to "inoculation; far from multiplying the contagion we must keep it away by taking the "same precautions and employing the same measures against that malady as have "proved so successful against leprosy and the plague."

The earliest account of the practical employment of such means is from Rhode Island, U.S.A. Haygarth, on the authority of Drs. Moffat and Waterhouse, states that for many years prior to 1778 small-pox had been successfully prevented from becoming epidemic there by regulations for isolation of the infected on a neighbouring small island specially used for that purpose, and for quarantining infected vessels, destruction of infected clothing, &c. Moreover, inoculation was discouraged at Rhode Island, and those who wished to be inoculated had to go to some place away from the Island, and were not to return until there was no danger of their infecting others.

457. A passage in Dimsdale's work on Inoculation, published in 1781, shows that in some towns of England pest-houses were beginning to be used for small-pox. In 1784 Haygarth, of Chester, published his "Inquiry how to prevent the Small-pox," and in 1793 "A Sketch of a Plan to Exterminate the Small-pox from Great Britain."

The great epidemic of small-pox at Chester in 1774, to which allusion has already been made, was the occasion of Haygarth's first attempts at organised dealing with epidemics of small-pox with a view to prevention. In his Inquiry he combated

Sydenham's doctrine that epidemics are due to some occult condition of the atmosphere, and argued that small-pox was always spread by infection only. He further maintained that the variolous poison could be carried as an infection for a little distance only through the air, and "consequently that the small-pox may be "prevented by keeping persons liable to the distemper from approaching within the "infectious distance of the variolous poison till it can be destroyed." These views led him, upon the return of an epidemic in 1777, to propose a plan for the prevention of the natural small-pox, and in 1778 a society was formed to carry out the plan in Chester. The plan consisted on the one hand of a general inoculation at people's homes at stated intervals, on the ground that the inoculated small-pox was far less fatal or injurious than the natural small-pox, and on the other hand of "Rules of Prevention" based on Haygarth's views of infection. In the report of the society, called shortly "The Small-pox Society," dated September 1782, it is stated that in the 4½ years of its existence two general inoculations had been held, and that the deaths from small-pox had been greatly lessened. Great difficulties, however, were met with. "A large pro-"portion of the inhabitants" refused inoculation, and a large proportion also "being "fearless, or rather desirous, that their children should be infected with the natural "small-pox," refused to obey the Rules of Prevention. Hence, though the same report states that the example of Chester had been followed by Liverpool, where "a "general inoculation was successfully executed in the autumn of 1781 and another in "the spring of 1782," and in Leeds, where a general inoculation was held in 1781, and another proposed in 1782, with such success that the Royal College of Physicians in Edinburgh appointed a committee to inquire into "the modes of conducting the "general inoculations of the poor" thus adopted in these places, the plan met with such difficulties that it was ultimately abandoned. It will be observed that a general inoculation was an essential part of the plan proposed and carried out in 1778–82; but, writing in 1784, Haygarth looked forward to being able ultimately to dispense with inoculation, and in the preface to his later edition, published in 1793, he states more definitely that the adoption of his Rules of Prevention without any general inoculation might exterminate small-pox in some country other than Great Britain. It must be remembered, however, that Haygarth entertained the opinion that the infection of small-pox could not be carried through the air above about half a yard, and that no one could be infected by the clothes of a person visiting a small-pox patient provided that he kept beyond this distance from the patient. It is obvious that if this had been established the control of the disease by isolation would be a much simpler matter than it really is.

458. In the Medico-Chirurgical Review for 1796 there appeared an account of a work by Dr. Faust of Leipsic, entitled "An essay on the duty of man to separate persons "infected with the small-pox from those in health, thereby to effect the extirpation of "that disease equally from the towns and countries of Europe," in which it was argued that the first person ill in a place is the only source from which all the rest, perhaps hundreds and thousands, become affected, and that if he were put immediately into a situation where he could not injure by contact those who had not had the disorder, the spread of the disease would be prevented.

In the same Review for 1799 appeared an account of establishments for the extirpation of small-pox. The failure of inoculation to attain the desired end is referred to, and legislation is urged to facilitate isolation. It is further stated that in 1796 the Prussian College of Physicians reported favourably to the King on the project, and that at Halberstadt it had been resolved to establish a house for the purpose. At Côte d'Or in France a similar plan had been tried with success.

459. In 1798 Jenner's Inquiry was published, and in the early years of this century inoculation began to be discouraged; for a while the prospects of annihilating small-pox by vaccination appear to have superseded, in the minds of many, the plans of Haygarth and others. Some vaccinators, however, like Willan and Ring, still looked to methods of quarantine and to national and municipal regulations promoting isolation to exterminate the small-pox.

It is worthy of notice, too, that Haygarth himself, in a letter quoted by Dr. Cappe of York in a communication to the London Medical and Physical Journal (Vol. IV., p. 429), dated October 13th, 1800, remarked, "an introduction of the vaccine still more "than of the variolous inoculation would effectually promote the great object of my "publications."

460. Prior to the year 1866 there was no provision made by law for enabling sanitary authorities to establish hospitals for infectious diseases and thus to promote

the isolation of such cases. The only institutions of that description then existing were the result of private effort. So far as regards small-pox there was, practically speaking, no provision for its treatment by means of isolation.

461. The Sanitary Act of 1866 empowered, though it did not compel, local authorities throughout England and Wales, Scotland, and Ireland, to provide or to join in providing isolation hospitals for the use of the inhabitants of their districts. There was further legislation on the subject by the Public Health Act, 1875; the Public Health (London) Act, 1891; the Public Health (Scotland) Act, 1867; and the Public Health (Ireland) Act, 1878, into the details of which it is not necessary to enter. The most recent Act relating to the matter is the Isolation Hospitals Act of 1893, which applies to the small towns and rural districts of England and Wales.

462. In London the local authorities to whom the power to provide isolation hospitals was given by the Sanitary Act of 1866 were in the City the Commissioners of Sewers and in other metropolitan districts the Vestries or District Boards. With few exceptions these authorities did not exercise the powers conferred on them, and, speaking generally, it may be said that the Sanitary Act of 1866 had practically no effect in London as regards the provision of hospital accommodation for small-pox. Some few of the metropolitan workhouses, however, had infectious wards attached in which cases of small-pox were treated, and the guardians of some of the unions sent cases by arrangement to the small-pox hospital at Highgate. This institution, which had been established in 1746, was extended in 1850 so as to provide accommodation for about 100 small-pox patients. It remained down to the year 1870 the only small-pox hospital in London.

463. The obvious difficulty and danger attending the treatment of persons suffering from small-pox in the same institutions in which other destitute persons are practically forced to reside led to the enactment of certain provisions of the Metropolitan Poor Act of 1867 and to the issue under that Act of an order of the Poor Law Board virtually uniting the whole metropolis into one district for the purpose, amongst others, of providing hospital accommodation for paupers suffering from small-pox.

464. Although the Metropolitan Asylums Board had power to provide hospital accommodation for paupers only, they found it practically impossible to confine the inmates of their hospital to this class owing to the epidemic which prevailed at and after the time when their first hospital was opened in December 1870.

465. In 1879, by the Poor Law Act of that year, power was given to the Metropolitan Asylums Board to contract with the local authorities for the reception into the Board's hospitals of any persons suffering from small-pox or other dangerous infectious disorder within their districts, but it was not until 1889 that express power was given to the Asylums Board by the Poor Law Act of that year to admit persons reasonably believed to be suffering from small-pox who were not paupers.

It will thus be seen that the hospitals of the Asylums Board have been practically the only isolation hospitals available for London, though to some extent the Highgate Hospital has served the same purpose.

466. A return made in 1879 showed that at that time 296 out of 1593 (or about 18 per cent.) of the sanitary authorities of England and Wales, other than the Metropolitan or port sanitary authorities, had made some provision for the isolation of cases of infectious disease. A similar return relating to the conditions existing in December 1892 shows that by that time 36·6 per cent. of the same sanitary authorities (representing districts together containing 62·1 per cent. of the total inhabitants) had some provision for the isolation of infectious diseases, either in hospitals of their own or by arrangement with neighbouring authorities, and that 20·4 per cent. of these authorities (representing districts containing together 44·6 per cent. of the total inhabitants) had special accommodation for small-pox patients. In addition, it appears that 45 of the 57 port sanitary authorities then existing (exclusive of the Port of London) in England and Wales had arrangements of some kind for the isolation of infectious diseases; 12 of these 45 then having special accommodation for small-pox patients.

467. The value of isolation in restricting the spread of small-pox has been long acknowledged by the Medical Officers of the Local Government Board.

Dr. (aftewards Sir George) Buchanan, in a report made in 1874, expressed the opinion that "small-pox, as well as other infections, is capable of being wonder-" fully limited by isolation in hospital, and the amount of provision made for such " isolation may be expected to affect materially the rate at which an epidemic of small-" pox becomes extinguished." In proof of this he adduces a striking comparison of the behaviour of the epidemic of 1870–1 in Birmingham, London, and Coventry. Again, the 1871 epidemic was prolonged in Plymouth, but quickly extinguished in adjacent Devonport, the only difference between the two being the more rapid and copious hospital provision in the case of the latter.

468. Evidence bearing on the same point was given by Dr. Thorne before the Royal Commission which in 1881–2 inquired into the subject of small-pox and fever hospitals in London.

Speaking of hospitals for infectious diseases generally, he said, "The evidence is so " abundant that I could occupy you for hours in telling you of instances in which " epidemics have evidently been prevented by the isolation of first cases of infectious " disease."

As regards small-pox in particular, he cites two striking examples, "Before the " erection of the Delancey Hospital at Cheltenham, small-pox had frequently led to " some considerable mortality; in 1858 it caused 52 deaths, in 1861, 12 deaths, in " 1865, 32 deaths, but during the six years which had elapsed between the provision of " the hospital and my inquiry, small-pox had been imported into Cheltenham on 12 " different occasions; the imported cases were, in every instance, removed to the " hospital, and in no single instance has the disease spread beyond the house first " attacked!" Again, he says: "At Birkdale, in Lancashire, the spread of small-pox " was, in 1876, successfully checked by the isolation of a few first attacks. At " Wigan, the isolation of a first imported case, both in 1877 and 1878, prevented any " further attack. At Maidstone I found that there had never been any spread of " small-pox in any house from which the medical officer of health succeeded in re-" moving to hospital the first patient attacked. Indeed, it was everywhere found that " where a hospital for the reception of infectious diseases was kept in actual readiness " for the admission of patients, and where removal could be effected at the outset of " the disease, the isolation of cases of small-pox had prevented any extension of " infection."

Dr. Thorne says: "It is really more striking as regards small-pox than any other " disease, because small-pox can be more easily isolated; the friends of the patient, " and they themselves being so much more willing to submit to isolation, than when " suffering from any of the other specific fevers." He adds, however, that "efficient " vaccination must be considered as a probable influence in contributing to the " results."

It is to be observed, too, that Dr. Thorne expressed the opinion that after an outbreak of small-pox had proceeded a certain way, the influence of a hospital for good upon the population would be very small indeed, that it would be good so far as concerned the individual house from which the patient was removed, but that it often had but little influence upon the general body of the epidemic.

469. After the hospitals established by the Metropolitan Asylums Board had been employed for some time for the reception of persons suffering from small-pox, attention was called to the fact that the number of cases of the disease in the neighbourhood of the hospitals was apparently in excess of the number found in streets further removed from them, and a suspicion was aroused that the hospitals were themselves causing a spread of the disease. There had appeared, according to Dr. Thorne, to be ground for believing that in the case of two provincial hospitals, one at Maidstone and the other at Stockton, the inhabitants of dwelling-houses in their neighbourhood had suffered owing to proximity to these institutions. In consequence of the suspicion which existed as to the influence of London hospitals in spreading the disease a careful investigation was made for the Local Government Board by Mr. Power of the circumstances relating to the Fulham small-pox hospital. In the result, he came to the conclusion that the Fulham hospital, with all its advantages of site and construction, and with the many excellences of its administration, had, by dissemination of small-pox material through the atmosphere, given rise to an exceptional prevalence of small-pox in its neighbourhood.

470. The matter was felt to be of so much importance that a Royal Commission was appointed to consider the prevention and control of epidemic infectious diseases in London and its neighbourhood.

The Commission arrived at the conclusion that it "appeared clearly established," by the experience of the five hospitals maintained by the Asylums Board for small-pox patients, that "by some means or other the asylum hospitals in their present shape "cause an increase of small-pox in their neighbourhoods." They accordingly recommended that these hospitals, which, in their judgment, should be no longer used to anything like the extent they then were for cases of small-pox, should become, in the main, fever hospitals, and that mild and convalescent cases of small-pox should be provided for in two or three more country hospitals, it being apparently thought impracticable to remove acute cases to such hospitals.

471. Towards the end of the year 1883 the Metropolitan Asylums Board, who had already made some use of a hospital camp at Darenth, and a hospital ship, the "Atlas," moored at Greenwich, for the treatment of small-pox patients, decided to make important changes in its method of dealing with London small-pox.

The "Atlas" hospital ship was moved to Long Reach, about 20 miles below London Bridge, and well without the metropolitan area, and re-opened in February 1884; the hospital camp at Darenth was re-opened early in the following month; in June of the same year a second hospital ship, the "Castalia," was opened alongside the "Atlas," and a second hospital camp opened at Darenth; and from February to October 1884 the cases of small-pox received by the Board were dealt with in the following manner: Cases of small-pox were received at first at three, and afterwards at six, intra-urban hospitals and there treated—(in May the hospitals at Hampstead and Fulham had been re-opened for this purpose and a sixth hospital hired at Plaistow, just beyond the metropolitan boundary but in a populous district)—but the number of cases under treatment in each intra-urban hospital at any one time was not allowed to exceed 50, mild and convalescent cases being thence transferred from time to time to the hospital ships and camps, where their treatment was continued; after the middle of June mild cases of small-pox were also received on the hospital ships directly from their homes. Complaints, however, again arose that some of the six intra-urban hospitals, and even that the hospital camps at Darenth, were spreading small-pox in their vicinity, legal proceedings being instituted with reference to the use of the latter; and from October 1884, though the Board continued for a time to follow the same method of dealing with cases of small-pox, but the number of cases under treatment in each intra-urban hospital at any one time was not allowed, as a rule, to exceed 25.

472. Finally, in July 1885, the Metropolitan Asylums Board decided thenceforward to treat, in the first instance, on the hospital ships, all cases of small-pox received by the Board, unless the condition of the patients made their removal to the ships dangerous; and the Board's arrangements, well designed and well carried out, for the conveyance of patients thereto, have since been found to admit of practically the whole of the cases being taken to the ships. As a relief to the hospital ships in times of small-pox epidemics, the Board erected in 1888–9, and extended in 1893–94, at Darenth, on a site near that before used for the hospital camps, a hospital primarily intended for cases convalescent after small-pox, which was so used during the later part of the small-pox outbreak of 1892–94. The Metropolitan Asylums Board have also provided, since 1881 a partial, and since 1889 a complete, ambulance service for London small-pox; and so well has the service, which formerly was often an undoubted means of infection, been carried on by the Board that it may, in this connexion at least, be taken that no spread of infection has occurred from the Board's ambulances.

473. In many of the large towns of England the notification of infectious diseases, including small-pox, has been at different times adopted, and steps have been taken to provide hospital accommodation where patients suffering from small-pox could be received, and endeavours made with more or less vigour to isolate cases of the disease by removing them to a hospital. We shall advert presently to the effect of these measures in the metropolis and some provincial towns. We may mention here, however, that the experience in London, that the collection of a considerable number of small-pox cases in hospitals situate in or near populous districts tends to a spread of the disease, has had its counterpart in provincial towns, though the greater numbers collected in one place have, we believe, made the evil more felt in London than elsewhere.

474. The reports upon recent provincial epidemics to which we have so often referred contain evidence bearing upon the danger of spreading the disease if considerable numbers of small-pox patients are aggregated in hospitals situate in populous neighbourhoods. Thus in Sheffield the Winter Street hospital appears to have led in the epidemic of 1887–88 to a dissemination of the disease in the vicinity. The site of the hospital has been since changed. Again at Leicester it was observed during the epidemic of 1892–93 that the amount of small-pox round the hospital was abnormally great when compared with the other parts of the town. And there was a similar experience at Warrington and other places.

475. As regards Scotland, the yearly abstracts of public health expenditure, given in the more recent reports of the Board of Supervision, enable us in some degree to judge of the extent to which local authorities have exercised the power to provide, or to join in providing, isolation hospitals for the use of the inhabitants of their districts, given to them by the Sanitary Act of 1866, and again by the Public Health (Scotland) Act of the following year. The earlier of those Acts, not having been framed with special reference to the local institutions of Scotland, was practically inoperative in that part of the United Kingdom, but some few local authorities may have from the first exercised their powers in this respect under the Act of 1867. The abstracts of expenditure given by the Board of Supervision do not enable us, however, specially to distinguish expenditure in connection with the provision or maintenance of hospital accommodation incurred prior to the year ending the 14th May 1873. From that year onwards the proportion, year by year, of local authorities making any such expenditure, however small, is shown by the following table :—

Year.	Proportion in each Year of Local Authorities making any Expenditure at all in connection with the Provision or Maintenance of Hospital Accommodation.	Year.	Proportion in each Year of Local Authorities making any Expenditure at all in connection with the Provision or Maintenance of Hospital Accommodation.
Ending 14th May 1873 -	5 per cent.	Ending 14th May 1884 -	13 per cent.
,, ,, 1874 -	6 ,,	,, ,, 1885 -	13 ,,
,, ,, 1875 -	7 ,,	,, ,, 1886 -	13 ,,
,, ,, 1876 -	7 ,,	,, ,, 1887	13 ,,
,, ,, 1877 -	8 ,,	,, ,, 1888 -	15 ,,
,, ,, 1878 -	9 ,,	,, ,, 1889 -	16 ,,
,, ,, 1879 -	10 ,,	,, ,, 1890 -	17 ,,
,, ,, 1880 -	10 ,,	—	—
		,, ,, 1891 -	34 ,,
,, ,, 1881 -	11 ,,	,, ,, 1892 -	39 ,,
,, ,, 1882 -	12 ,,	,, ,, 1893 -	44 ,,
,, ,, 1883 -	12 ,,	,, ,, 1894 -	49 ,,

476. The largely increased proportion of local authorities making some expenditure in connection with the provision or maintenance of hospital accommodation during the year ending the 14th May 1891, as compared with the proportion in the previous year, probably does not indicate any material increase in the amount of hospital accommodation provided. At the beginning of that year (*i.e.*, in May 1890), under the provisions of the Local Government (Scotland) Act of 1889, there were substituted for certain of the local authorities under the Public Health (Scotland) Act of 1867 a very much smaller body of authorities, representing larger areas in which the districts of the former authorities were merged. Apart, therefore, from any increase which may have followed in the amount of hospital accommodation provided, the effect was naturally to increase the proportion of local authorities making some expenditure in connexion with the maintenance of hospital accommodation.

At the same time the success, in this respect, at all events, of the policy of this substitution, is strikingly shown by the increased proportion of local authorities making some expenditure in connection with the provision or maintenance of hospital accommodation during the year ending the 14th May 1892, and during each of the two following years, as compared with the proportion during the year ending the 14th May 1891.

477. In the case of Ireland, we are able to judge to some extent of the proportion of cases of small-pox which, prior to the enactment of the Sanitary Act of 1866, was

treated in hospitals or infirmaries of some sort. The inquiries, to which we have already referred, made on the taking of the census in 1841, in 1851, in 1861, and in 1871 gave the following results:—[Census reports of Ireland: in 1841, pp. xii, xiii, lix, and lx, and pp. 182 and 194–204 of Surgeon Wilde's Report; in 1851, part v., vol. i., pp. 364–5 and 423, and vol. ii., pp. 70, 110, and 122; in 1861, part iii., vol. ii., p. 20, and (in the tables) pp. 66, 106, and 118; and in 1871, part ii., vol. ii., pp. xxxvii, 122, 154, 168, and 256.]

58,006 persons were returned as having died of small-pox during the inter-censal period 1831–41. Of these 58,006 deaths, 19 occurred in the few Poor Law institutions which had been opened towards the close of the period; 16 occurred in county hospitals; 5 in prison hospitals; 38 in other general hospitals; and 49 in fever hospitals. So that altogether 127 out of the 58,006 deaths (or 0·2 per cent.) occurred in these institutions.

38,275 persons were returned as having died of small-pox during the inter-censal period 1841–1851. Of these 38,275 deaths, 5,016 (or 13·1 per cent.) occurred in Poor Law institutions; 8 occurred in county hospitals; 4 in prison hospitals; 26 in other general hospitals; and 593 in fever hospitals. So that altogether 5,647 out of the 38,275 deaths (or 14·7 per cent.) occurred in these institutions.

12,727 persons were returned as having died of small-pox during the inter-censal period of 1851–61. Of these 12,727 deaths, 1,118 (or 8·8 per cent.) occurred in Poor Law institutions; 4 occurred in county hospitals; 9 in prison hospitals; 57 in other general hospitals; and 187 in fever hospitals. So that altogether 1,375 out of the 12,727 deaths (or 10·8 per cent.) occurred in these institutions.

4,113 persons were returned as having died of small-pox during the inter-censal period 1861–71. Of these 4,113 deaths, 435 (or 10·6 per cent.) occurred in Poor Law institutions; 2 occurred in county hospitals; none in prison hospitals; 22 in other general hospitals; and 107 in fever hospitals. So that altogether 566 out of the 4,113 deaths (or 13·8 per cent.) occurred in these institutions.

478. The figures just given relate to deaths from small-pox only and not to all cases of that disease however terminating. But unless the rate of fatality during the periods to which they relate was considerably lower amongst cases of small-pox treated in the institutions mentioned than amongst cases treated outside, which is unlikely to have been the case, we may infer from the figures that in Ireland the proportion of cases of small-pox which were treated in hospitals or infirmaries of some sort did not materially exceed 0·2 per cent. during the inter-censal period 1831–41, 14·7 per cent. during the inter-censal period 1841–51, 10·8 per cent. during the inter-censal period 1851–61, and 13·8 per cent. during the inter-censal period 1861–71. It must not, of course, be assumed that the cases so treated were effectually isolated during their treatment.

479. We have not the same means of estimating the proportion of cases of small-pox in Ireland which have been treated in hospitals or infirmaries of some sort since the close of the inter-censal period 1861–71. The power, given to local authorities by the Sanitary Act of 1866 and again by the Public Health (Ireland) Act of 1878, to provide, or to join in providing, isolation hospitals for the use of the inhabitants of their districts, has been exercised in Ireland to a far less extent than the similar power in England and Scotland; indeed, except in the case of some few towns in quite recent years, it can scarcely be said to have been exercised at all. On the other hand such isolation of cases of small-pox as may have been effected by their treatment in Poor Law institutions was carried out more generally in Ireland during the decennial period 1871–80 than during any of the inter-censal periods to which we have referred, and still more generally and indeed to a very large extent during the next decennium 1881–90. The returns of deaths in workhouses from small-pox, given in the annual reports of the Local Government Board for Ireland, show that the proportion of the deaths from small-pox in Ireland which occurred in those institutions was about 25 per cent. during the period 1871–80, and about 65 per cent. during the period 1881–90. Unless, therefore, the rate of fatality during these periods amongst cases of small-pox treated in those institutions was materially different from the rate of fatality amongst cases treated outside, it would appear that about one case of small-pox out of every four during the period 1871–80, and about two cases out of every three during the period 1881–90, were treated in Poor Law institutions.

480. Passing now to a consideration of the effect produced by a notification of cases of small-pox and the steps taken to isolate them, we naturally begin with Leicester.

The method there employed in dealing with small-pox has attracted much attention, and is often spoken of as the "Leicester system."

As some discussion has arisen as to the exact procedure under the Leicester system, it will be well to briefly state in what it consists. On the receipt of a notification at the Health Office, a telephonic message is sent to the hospital to prepare for the reception of a patient, and to despatch the ambulance; the sanitary inspector at once proceeds to the house notified, and urges the removal of the patient to hospital, and also the removal of those who have been in contact with him to the quarantine wards near the hospital. There is rarely any difficulty in securing the removal of the patient; in the case of the other inmates of the infected house, there is no power of compulsory removal, but persuasion has generally been successful. If a person liable to infection is not quarantined, he is visited daily by the inspector; he is warned against going to work, or undue exposure, but is not confined to the house. Compensation has been given in some cases. The history of the small-pox patient is then inquired into, especially his whereabouts, and the persons he has been in contact with during the preceding fortnight, and any clue of infection is vigilantly followed up. Meanwhile, the house is thoroughly disinfected, and clothing is either burnt or sent to the steam disinfector on the hospital grounds. There are 28 beds ordinarily set aside for small-pox in a separate pavilion at the hospital; in another building, fenced off from this but very near it, cases of scarlet fever are received, and the quarantine wards are separated from the fever wards by a corridor only.

If no small-pox appears among those quarantined, they are allowed to return after 14 days; vaccination or re-vaccination is offered them, but it has not been largely accepted. From 1877 to 1891 inclusive it appears that 183 persons were thus quarantined, and 103 patients were treated in the small-pox hospital. Of 14 persons quarantined in 1887 two developed small-pox, and of 39 quarantined in 1888 three developed small-pox.

481. Leicester suffered severely from small-pox in 1872, 346 deaths having been registered as caused by it. Two deaths from that disease occurred in 1873, but no other until 1877, when there were six, and one in the following year. The next year in which small-pox deaths were registered was 1881. There were two in that year and five and three in the following years. No other death took place until 1892 and 1893, in which years the fatal cases numbered 21.

Prior to 1875 the vaccination laws were well observed in Leicester. In that year the number of children born who were unaccounted for was only some 4 per cent. Since then there has been, as we have seen, a marked and progressive decline in the number of vaccinations, especially since 1883, until at the present time 80 per cent. of the children born remain unvaccinated.

482. The borough hospital for infectious diseases was erected in 1871–2 outside the town; though within the last few years houses have been built in proximity to it. It appears to have been with Dr. Crane, the Medical Officer of Health in 1875, that the quarantining the inmates of an infected house, in addition to isolating the patient, originated. His successor, Dr. Johnston, established it in 1877 as a regular system. He was aided in this, after 1879, by the notification of infectious diseases then rendered compulsory by a private Act which Leicester, anticipating most other towns, obtained in that year. Dr. Johnston reported that up to 1884 the spread of small-pox from imported cases had been arrested in 20 instances by the means he adopted.

His successor, Dr. Tomkins, though, like his predecessors, regretting the increasing disuse of vaccination, bore testimony in his annual reports to the efficacy of the measures adopted in Leicester, and expressed his opinion that had such a system been in force at Sheffield in 1887 it would not have suffered in the way it did.

483. In 1892 small-pox became prevalent in different parts of England, especially in Lancashire and Yorkshire. Many of the large provincial towns suffered, and Leicester amongst them. There were in 1892–3, 357 cases of small-pox in Leicester, of whom 21, or 5·8 died. 193 households were invaded, containing 1,234 persons. The first importation was by a tramp, whose disease, passing unrecognised, caused infection at a common lodging-house and at the workhouse. 11 other importations of the disease by tramps occurred in the course of 1892–3. When the first cases were removed to the hospital the fever wards were full of children suffering from scarlatina, and others, convalescent from that disease, were lodged in a neighbouring pavilion. It is not surprising that a number, amounting in all to 13, of the scarlatinal children caught

small-pox, some of these apparently from contact with a child who, during quarantine, developed a scarlatinal rash, and later an eruption, which was at first erroneously thought to be chicken-pox. The children from the fever wards were sent home in October 1892, but six of them were re-admitted to hospital with small-pox within a fortnight. From this time onward the whole of the hospital was devoted to small-pox cases, and to quarantined persons. It was, however, soon found impossible, for lack of accommodation, to remove all the inmates of the infected houses to the quarantine wards at the hospital; and from May 1893 onwards, quarantine was superseded by a system of daily visitation and inquiry.

484. An analytical study of the incidence of small-pox on 193 households, containing 1,234 inhabitants, shows that in the 170 instances in which the first or only case of small-pox was removed to hospital, 85 cases occurred among the 915 other inmates, or 9·2 per cent. In the 23 instances in which the first or only case of small-pox remained at home, 42 cases occurred among the 126 other inmates, or 33·3 per cent. Both in the vaccinated and the unvaccinated a far greater proportion of the inmates were attacked when the first case remained at home than when removed to hospital.

The influence of promptitude in removal upon the development of secondary cases is shown by the following facts. In 120 of the 170 houses from which the first or only case of small-pox was removed, there were no further cases. Removal had been effected on or before the fifth day of attack in 60 per cent. of the cases so removed. In the remaining 50 houses out of the 170, one or more further cases of small-pox occurred. Removal had been effected on or before the fifth day in only 38 per cent. of the first cases occurring in these houses.

485. The evidence derived from the complex conditions which obtained at Leicester during the outbreak of 1892–3, is inconclusive as to the relative merits of quarantine in hospital or supervision of the exposed at their homes. The influence of prompt isolation of the patient appears to overshadow any superior efficacy the one method may have had over the other.

486. Leicester suffered less than many of the other large towns which have been invaded by small-pox during recent years, both in the number of cases and in the number of deaths. In connexion with this, however, a point to which we have already called attention must be borne in mind. The disease was remarkably slight there in its fatality, even as regards those who, by reason of their age, could not be affected by the change of practice in relation to vaccination. Dr. Priestley, the Medical Officer of Health, claims, in his report to the Sanitary Committee for 1893, that it was by reason of the energetic methods adopted that the disease had been prevented running riot through the town. His claim may be well-founded. At all events, the experience of Leicester affords cogent evidence that the vigilant and prompt application of isolation, &c., even with the defects which were brought to light during the recent epidemic, is a most powerful agent in limiting the spread of small-pox. It is true that the system and appliances which appeared adequate for some years failed to prevent a serious outbreak of small-pox in 1892–3. We think its value was none the less real. We shall consider the matter further when we come to review the whole of the evidence on the subject of isolation and notification.

487. The system of isolation has been adopted more or less completely in many provincial towns, and has there proved of value.

At Sheffield, during the epidemic of 1887–8, there was no compulsory notification, though a voluntary system of notification by medical men had been in vogue since 1885. Only one-fourth of the 32 cases of small-pox known to have occurred during the first three months of the epidemic were thus notified. Though the proportion of notified cases increased as the epidemic progressed, it is evident that during the most important period the system must be regarded as having failed. The borough hospital in Winter Street, which for a considerable period was the only hospital in use, did not provide adequate accommodation for patients, and became overcrowded; moreover, being in proximity to a densely populated area, it became the means of spreading the disease. Cases of small-pox were accordingly treated in buildings or huts in connexion with the Sheffield and Ecclesall Unions' Workhouses, and the disease spread to inmates of the workhouses. Nevertheless, evidence is forthcoming from Sheffield of the great advantage to individual households of early removal of first cases. Dr. Barry says:—

"The advantages arising to individual households from the early removal of small-" pox cases to hospitals were clearly seen in the earlier months of the epidemic.

" From its commencement to the middle of July, during which period, with com-
" paratively few exceptions, all cases of small-pox which came to the knowledge of
" the Health Department were at once removed to hospital, it was exceptional to have
" a recurrence of the disease in the same household. After the middle of July, in
" consequence of the insufficiency of hospital accommodation, a large and increasing
" proportion of small-pox cases had to be treated in their own homes, and multiple
" cases in families became of frequent occurrence.

" The beneficial effect upon groups of households and districts of the early removal
" of cases to hospital is evident from the following notes with regard to the sub-
" districts of South Sheffield, Attercliffe, and Upper Hallam, all districts at a consider-
" able distance from the hospital.

" Small-pox was introduced into South Sheffield in July, during which month two
" persons living in different houses contracted the disease. Both cases were at once
" removed to hospital. During August two more houses were invaded, and the cases
" were similarly dealt with. No fresh cases occurred in this district till October, when
" the disease was again introduced, and in consequence of the want of accommodation
" in the hospitals, cases had to be treated at home. During this month 25 households
" were attacked, and from this time onwards the number of fresh households affected
" rapidly increased.

" Small-pox was introduced into Attercliffe in the third week in July, and the person
" who had contracted the disease was at once removed to hospital. No further case
" occurred in this district until in the fourth week in August a house situated in a
" different part of the district to that last mentioned became affected. In consequence
" of the want of accommodation in the hospital it was two or three days after the
" development of the disease before this case could be removed, and in the following
" fortnight six new cases occurred, of which three were in the same house as the
" person above referred to. Of the three cases in fresh houses two were removed
" to hospital and one was treated at home. In the following fortnight two fresh
" houses in the same neighbourhood were invaded, and from this time cases occurred
" more frequently. In October there were 11 new cases, in November 24, in
" December 67, in January 1888, 140, in February 150, and in March 170, only a
" small proportion of these later cases being removed to hospital.

" In Upper Hallam the first case of small-pox was reported to have occurred on
" June 18th. This was at once removed to hospital, as was also a second case which
" occurred on July 1st. No further cases were reported to have occurred in this
" district till September 20th, when there was a case which was also at once removed
" to hospital. From that date till December 29th, when the disease was re-introduced,
" no more were reported to have occurred in the district."

The experience gained in 1887–8 has borne fruit; in 1889 Sheffield adopted the Compulsory Notification Act, and when small-pox broke out there in 1892–3 all cases were promptly removed to the new hospital at Lodge Moor, four miles from the centre of the town and in an isolated position. So convinced is the medical officer of the need for isolating those attacked that he is in favour of insisting on removal in any case. Moreover, provision has been made at Lodge Moor for isolating members of infected families, or others who have been exposed to infection and quarantining them for 15 days. 18 persons were thus quarantined in the outbreak of 1892–3. To these measures and to the influence of the epidemic of 1887–8, when 6,088 persons suffered from small-pox, of whom 589 died, as well as to the numerous cases of re-vaccination, is ascribed the non-extension of the disease in 1892–3. Sheffield had obeyed the vaccination laws better even than the average of large towns. Had there been prompt removal of first cases to adequate and suitable hospital accommodation in 1887, it is in the highest degree improbable that the disease would have run riot as it did. It is important to notice that the rapid spread of the disease at the commencement of the epidemic of 1887–8 seems to have been due to the fact that some of the early cases were of so mild a character that they passed unobserved.

488. At Halifax in 1893, owing to inadequacy of accommodation, an attempted quarantine of infected households at the hospital broke down, the disease was spread from common lodging houses, and invaded the poorer portions of the town, and was especially prevalent in the neighbourhood of the small-pox hospital.

489. At Bradford the fever hospital has on many occasions since 1874 afforded isolation for small-pox cases, and effectually prevented its spread in the borough. It was formerly in an isolated situation, but houses have now been built close to the walls

of the hospital grounds, and in these there was a special incidence of the disease in 1893. Owing to the prevalence of scarlet fever, the accommodation for small-pox proved inadequate, and a temporary hospital was erected at Scholemore. Unfortunately a fire broke out here in October 1893, necessitating the removal of the patients, and causing a further extension of the disease as well as seriously dislocating hospital isolation. Quarantining was only attempted on a small scale at Bradford, in a house accommodating four persons.

490. Without entering into further details, we may state that the advantage of hospital isolation has been felt in Glasgow, Leeds, and other towns.

491. We have already directed attention to the fact that it was practically speaking not until 1871 that hospital accommodation was provided in London, which rendered possible the removal from their homes of persons suffering from small-pox, and we have detailed the measures adopted from time to time for that purpose.

As these facilities were augmented, the proportion of cases treated in the Metropolitan Asylums Board's hospitals steadily increased:—

Years.	Number of Deaths from Small-pox registered in London, or (of London Residents) in the Metropolitan Asylums Board's Hospitals situated outside London.	Number of Deaths from Small-pox in the Metropolitan Asylums Board's Hospitals.	Deaths in Metropolitan Asylums Board's Hospitals—Per Cent. of Total Deaths.
1871–2 - - -	9,643	3,020	31
1881 - - - -	2,373	1,431	60
1893 - - - -	206	180	87

The deaths shown by the table in the last of these years are not those which occurred in the hospitals during that year, but the deaths of patients who during that year were admitted to the hospitals. This does not, however, detract from the importance of the figures as evidence of the great increase in the proportion of small-pox cases treated in the hospitals.

492. The Royal Commission to which we have referred, in their Report made in July 1882, contrasted the amount of small-pox in London with that which had occurred in England generally It will bo well to bring such a comparison down to the present time and to notice the features which it presents.

The following table affords a comparison between the mortality in London and that in England and Wales with the metropolis excluded, the deaths being those from small-pox to every 100,000 living. The figures are taken for the five years 1838– 2, and from 1847 onwards in decennial periods, the figures for the years 1843–6 not being procurable.

—	Mean annual Deaths from Small-pox to every 100,000 living.	
	England and Wales, excluding London.	London.
1838–42 - - -	54·5	77·1
1847–56 - - -	23·6	34·6
1857–66 - - -	20·0	26·8
1867–76 - - -	22·5	41·9
1877–86 - - -	3·3	27·4

493. It will be seen that during the second and third periods, there was a great reduction of mortality both in England, excluding the metropolis, and in London; though it must be remembered that 1838–42 includes 1838, in which there was a considerable epidemic. The great epidemic wave of small-pox which swept over the country in 1870–1, and which made itself felt in almost every part of Europe, naturally produced a sensible effect on

the mortality of the next decennium, but it is to be noted that its effect was much more serious in London than outside the metropolis. The mortality there, though raised higher than in the previous decennium, did not reach the point at which it stood in the decennium before that. In London, on the other hand, the mortality largely exceeded that of the two previous decennia. Again it is to be observed that though in the next decennium the mortality fell, both in England generally and in the metropolis, the fall was very different in its extent; outside the metropolis it was vastly greater than within it. It is only since the year 1885 that the condition of London has been at all comparable as regards the amount of small-pox mortality with the rest of the country. The corresponding figures for the years 1887–94 to those given above are as follows:—

——	England and Wales, excluding London.	London.
1887–94 - - -	2·0	1·0

494. In the Report of the Royal Commission of 1881, already alluded to, suggestions were made with regard to notification and isolation which have since been largely carried into effect. As we have said, it was considered proved that the existing small-pox hospitals had caused a spread of the disease in their neighbourhood. We cannot but think that this may in some measure account for the greatly increased mortality from small-pox in London during the 1871–72 epidemic as compared with the rest of the country. It is true that the statistics relating to England and Wales outside the metropolis include those of other large towns where the same evil was present, but it probably did not exist then in so aggravated a form, and the effect may be neutralised by the statistics relating to smaller towns and rural districts with which they are combined. This idea has been suggested to us, as the result of the inquiry, how it has come about that whilst the metropolis, in the decennium 1867–1876 and again down to 1885, compared so unfavourably with the rest of the country, the condition has since that date become so entirely changed? We think it is impossible to attribute this change to vaccination. There is no reason to suppose that the position of the metropolis in respect to vaccination has, since the year 1885, become superior to the rest of England and Wales; rather the other way, as the decrease in infantile vaccination has been greater during the last few years than in the rest of England and Wales. The change, therefore, must be due to some other cause.

495. The hospitals which, in the opinion of the Commissioners, were propagating the disease in their neighbourhood, were in operation down to July 1882, when their Report was made. In 1877 and 1878 and again in 1881, small-pox was epidemic in London to a considerable extent.

We have stated in detail in paragraph 471 the steps which were taken by the Metropolitan Asylums Board in consequence of the recommendations of the Royal Commission. It will be seen that the intra-urban hospitals still continued in use, and that complaints were made in 1884 that they were spreading small-pox in their vicinity, although the number in each of them was not allowed to exceed 50. In October 1884 this number was reduced to 25. It was not, however, until 1885 that the system, now in operation, was inaugurated, and all cases of small-pox were treated in hospital ships. It is impossible not to be struck with the fact that it is, since the year 1885, that the metropolis has presented so satisfactory an aspect as regards small-pox mortality. The facts to which we have been calling attention certainly seem to point to the conclusion that this has been due to a system of isolation, well organised and administered, the beneficial effect of which is no longer neutralised by a spread of the disease from the hospitals in which the isolation is carried out.

Upon the whole, we think the experience of London affords cogent evidence of the value of a sound system of isolation in checking the spread of small-pox.

496. The experience of isolation systems in Australia is interesting and worthy of special notice, because whilst in this country the quarantining of persons who have come in immediate contact with those suffering from small-pox has only been possible with the consent of the persons whom it was proposed to subject to quarantine, in Australia their removal to a place of isolation has been made compulsory.

497. Australia, by virtue of its geographical position, and the consequent separation by long sea voyage from infected ports, enjoyed for a long time a sort of natural isolation. Thus, Hirsch, in his "Historical and Geographical Pathology," Vol. I., pp. 133-4 (1881), remarks:—

"The continent of Australia up to 1838 had enjoyed an absolute immunity from " small-pox; towards the end of that year the disease appeared at Sydney, having " been imported probably from China; it lasted, however, only a short time, and " remained absent from the continent until 1868. In that year it was introduced into " Melbourne by a ship, and again it spread only to a slight extent, and quickly died " out. By a rigorous inspection of ships on their arrival, it has been found possible " to prevent subsequent importations, a notable instance of prevention having " occurred in 1872. Tasmania has hitherto quite escaped the disease; so also has " New Zealand, where an importation of it in 1872 was prevented by strictly isolating " a vessel that had arrived with small-pox on board."

In New South Wales, Dr. MacLaurin, who has been President of the Board of Health since 1889, informed us that the Government act on the assumption that small-pox is an exotic disease, and that every case must have come from outside the colony, and it is therefore dealt with under a quarantine Act of William IV., originally instituted for dealing with cholera. By an Act passed in 1882, notification of small-pox was made compulsory on medical men and householders under heavy penalties. At Sydney notification of small-pox is followed up by the compulsory removal of the patient and all persons who have been in the house with the patient to the quarantine station at North Head. This station is 670 acres in extent, and situated on the peninsula at the mouth of Sydney Harbour, and is seven miles from the Health Office, with which there is telephonic and telegraphic communication. The persons are conveyed to the station by a steamboat comfortably fitted expressly for the purpose, and no difficulty has been experienced in effecting their removal. It was, in Dr. MacLaurin's opinion, by carrying out this practice of isolation and quarantine that "the epidemic of 1881–82 was suppressed," and small-pox "has never become epidemic since this plan has been adopted." The persons who have been in the house with the patient are detained 21 days in quarantine from the date of the last possible contagion. Should a case of small-pox arise among them, those who had been in contact with such infected person would be detained for a further period of 21 days, and so on. To facilitate this the exposed persons are distributed in separate groups within the station. They are allowed to receive letters or parcels, &c., and a telegraph operator is employed, "whose special " business it is to work the telegraph at their request." "Reasonable compensation is " given by the Government for loss;" and there are heavy penalties under the original Act whereby the quarantine is secured. The station is, according to Dr. MacLaurin, " a pleasant place to stay in, and everything is done that can be done to make the " people comfortable; they have nothing whatever to do, and are free from all care, " and they can spend the day pleasantly enough; but they do not like it." No one, however, raises any objection to the Sydney system; "the people are all very sensible about it." In all Australian towns the same system is carried out as strictly, with the result that there was not a case of small-pox in Australia on the 5th February 1890; and Dr. MacLaurin is of opinion that the risk of dying of small-pox in Australia is smaller than in any other part of the world. As regards vaccination:—In New South Wales it is very little practised; there is no compulsory Act; and though medical opinion is in favour of it, an opinion shared by Dr. MacLaurin, it is not likely that a compulsory Vacccination Act could be passed or would be tolerated. The proportion of young persons in New South Wales who are not vaccinated is accordingly very large; probably much more than half of those under ten years of age are unvaccinated. Although Dr. MacLaurin favours vaccination and respects it highly, he is satisfied that the system of isolation as supervised by him is perfectly successful. As President of the Board of Health he considered it his business to produce extinction of the disease; he does not consider vaccination a sufficiently absolute protection for such purpose; and he is "fully of opinion that the only way in which you can bring " to an end an outbreak of small-pox, that is to say, to bring it under control, and not " leave it to work itself out, is by notification and isolation. Of course in any small " community, if you let the disease in it will work itself out in time, because all the " susceptible people will have had it; but the only way in which you can absolutely " control an epidemic of small-pox is by a system of notification and isolation."

498. Small-pox has never been epidemic in Western Australia. Only one case has occurred within the last 31 years, and that was an imported one; quarantine was

carried out and no infection occurred; the immunity from the disease is mainly at least due to isolation. Before 1879 vaccination was not generally practised, a great majority of those born in the colony were unvaccinated; in that year a compulsory Vaccination Act was passed in consequence of Sir H. Ord and Dr. Waylen's representations, and in consequence of reports of small-pox in other colonies, and not on account of the existence of small-pox in Western Australia.

In Tasmania there was a compulsory vaccination law, but it was found to be inoperative because no one was appointed to conduct the prosecutions, and it has now fallen into desuetude. The same system of isolation and quarantine is exercised as in the other Australian colonies. Small-pox was for the first time introduced into Tasmania in 1887, and although preparations for isolation were inadequate, the disease was soon stamped out. Communication between Launceston and Melbourne was temporarily suspended, and to this precaution the non-invasion of Victoria was attributed. The particulars of this, the first introduction of small-pox into Tasmania during the history of that colony, are to be found in a report to the Central Board of Health by Mr. A. Mault, dated November 17, 1887. The origin of the outbreak is not clear, but it was presumed to have been imported, probably by a ship from China, into Launceston. The earliest case reported to the Local Board of Health was on September 23, though it appears that earlier cases had passed unnoticed, or had been notified as measles. 33 cases in all occurred, every one of which was traced to direct infection to the first case. By September 27 a temporary hospital had been erected, and thither patients and suspects to the number of 72 were removed. The last case appeared on October 13. Other persons who had been to the infected houses were isolated in their houses and watched. Only four of the 47 persons quarantined at the station were attacked. The clothing was burnt, and very thorough disinfection of the infected houses was carried out, and the dead were interred in a special cemetery. The other colonies were communicated with, and quarantine, at first unduly rigid, and afterwards relaxed, was practised against ships proceeding from Tasmania. Although vaccination had been nominally compulsory in Tasmania, it was estimated that two-fifths of the population were unvaccinated.

499. We have no difficulty in answering the question, what means other than vaccination can be used for diminishing the prevalence of small-pox?—We think that a complete system of notification of the disease, accompanied by an immediate hospital isolation of the persons attacked, together with a careful supervision, or, if possible, isolation for sixteen days of those who had been in immediate contact with them, could not but be of very high value in diminishing the prevalence of small-pox. It would be necessary, however, to bear constantly in mind as two conditions of success, first, that no considerable number of small-pox patients should ever be kept together in a hospital situate in a populous neighbourhood, and secondly, that the ambulance arrangement should be organised with scrupulous care. If these conditions were not fulfilled, the effect might be to neutralise or even do more than counteract the benefits otherwise flowing from a scheme of isolation.

500. When we turn to the other branch of the inquiry, how far such means could be relied on in the place of vaccination, we find ourselves involved in questions of a much more complicated nature. We have little or no experience to fall back upon. The experiment has never been tried. The nearest approach to a trial of it has probably been in Australia. But even in the parts of that country to which we have alluded the population has not been entirely unvaccinated, though there has been a large unvaccinated class amongst it. Moreover, in applying the experience of Australia to this country two things must be borne in mind. In the first place small-pox has only appeared from time to time, introduced from without at one or other of the ports of the country, and the several colonies of which Australia is composed are of great territorial extent, with few large centres of population. In this country small-pox is always present in some part of it. There has not been a single year without several deaths from the disease. Large centres of population are numerous, and the intercourse between them constant. In the several colonies of Australia the number of ports is not great, the vessels which enter them are comparatively speaking not numerous, and the ports from which they arrive are many days' voyage distant; and there are careful arrangements for quarantining vessels to exclude disease. The shipping which enters English ports is of vast quantity, and passengers are brought in large numbers from the continent of Europe not only daily, but it may almost be said hourly; the voyage, too, is but brief. The other matter to be

remembered, is that part of the Australian system is the *compulsory* removal to quarantine for 21 days of those who have been in the house with the patient, in addition to the transfer of the patient himself to a hospital. There can be no doubt that such a system, if completely carried out, would be of the highest efficacy. But it is obvious that in this country the practical difficulties of working such a scheme in the large towns would be really insuperable, to say nothing of the difficulty of procuring legislative sanction for it.

501. In order to maintain in efficiency the primary essential condition of a system of isolation, viz., the immediate isolation of a person attacked by the disease, it is requisite to have a hospital always ready with sufficient accommodation for the reception of all such cases, and there are no means of estimating what extent of accommodation will suffice to meet at all times the necessities of a particular town. It is certain that the disease spreads more rapidly, its contagion seems to operate more actively, at one time than at another. If an epidemic affects a locality, the preparations made for the isolation of small-pox cases, which have proved to be fully adequate in ordinary years, may turn out to be quite inadequate. It is impossible at once to provide the needed hospital accommodation. If the cases are to be removed to a hospital at all, the massing of large numbers together, in itself a means of spreading the disease, might prove inevitable. We have only to look at what happened at Leicester to see how suddenly the necessities of the case may outrun the preparations made for isolation. Moreover, although the vaccination of children had been neglected in Leicester for many years, it would be quite a mistake to regard it as an unvaccinated town. The population over 20 years of age were probably well-vaccinated, and a large proportion of those between 10 and 20 years of age were vaccinated persons. More than half even of those between 7 and 10 years of age at the commencement of the epidemic must be placed in the same category.

502. The question we are now discussing must, of course, be argued on the hypothesis that vaccination affords protection against small-pox. Who can possibly say that if the disease once entered a town, the population of which was entirely or almost entirely unprotected, it would not spread with a rapidity of which we have in recent times had no experience, or who can foretell what call might then be made on hospital accommodation if all those attacked by the disease were to be isolated? *A priori* reasoning on such a question is of little or no value.

503. We can see nothing then to warrant the conclusion that in this country vaccination might safely be abandoned, and replaced by a system of isolation. If such a change were made in our method of dealing with small-pox, and that which had been substituted for vaccination proved ineffectual to prevent the spread of the disease (it is not suggested that it could diminish its severity in those attacked), it is impossible to contemplate the consequences without dismay.

To avoid misunderstanding, it may be well to repeat that we are very far from underrating the value of a system of isolation. We have already dwelt upon its importance. But what it can accomplish as an auxiliary to vaccination is one thing whether it can be relied on in its stead is quite another thing.

504. Even admitting fully the protective effect of vaccination it does not, in our opinion, diminish the importance of measures of isolation or dispense with their necessity. We think that steps should be taken to secure a more general provision for the isolation of small-pox patients than exists at present. We have already called attention to the fact that mischievous results are likely to follow the use as a small-pox hospital of a building situate in a populous place. We think that wherever it is placed it should have sufficient space around it to enable the Sanitary Authority to add rapidly to the accommodation by the erection of temporary buildings.

505. Sanitary Authorities are now sometimes reluctant to provide isolation hospitals. We think that, on a petition by a prescribed number of the ratepayers in a sanitary district, the Local Government Board, if satisfied that hospital accommodation ought to be provided, should have power to make an Order for such provision.

506. Power should, in our opinion, be conferred on Sanitary Authorities to give compensation for loss of wages, and generally for any expenses occasioned either by the isolation of patients, or persons who have come in contact with them, or such supervision of them as is necessary, whether in hospital or elsewhere.

507. Our attention has been drawn to the circumstance that outbreaks of small-pox have not unfrequently had their origin in the introduction of the disease to common lodging-houses by tramps wandering from place to place. In view of this we make the following recommendations:—

(i.) That common shelters which are not now subject to the law relating to common lodging houses should be made subject to such law.

(ii.) That there should be power to the local authority to require medical examination of all persons entering common lodging-houses and casual wards to see if they are suffering from small-pox, and to offer a reward for prompt information of the presence of the disease.

(iii.) That the local authority should have power to order the keeper of a common lodging-house in which there has been small-pox to refuse fresh admissions for such time as may be required by the authority.

(iv.) That the local authority should be empowered to require the temporary closing of any common lodging-house in which small pox has occurred.

(v.) That the local authority should have power to offer free lodgings to any inmate of a common lodging-house or casual ward who may reasonably be suspected of being liable to convey small-pox.

(vi.) That the Sanitary Authority should give notice to all adjoining Sanitary Authorities of the occurrence of small-pox in common lodging-houses or casual wards.

(vii.) That where the disease occurs the Public Vaccinator or the Medical Officer of Health should attend and vaccinate the inmates of such lodging-houses or wards, except such as should be unwilling to submit themselves to the operation.

508. In connexion with the subject with which we have been dealing we may advert to the suggestion that the vaccination and the sanitary authority should in all cases be identical. It has been pointed out that whilst the isolation of patients in hospitals and otherwise is provided for by the sanitary authority the extent of the provision requisite to deal with the outbreak of an epidemic of small-pox may depend upon the degree in which the vaccination laws have been enforced. More hospital accommodation may be required where vaccination has been neglected than where the vaccination laws have been complied with. It is contended that sanitation and vaccination, concerning as they both do the health of the people, should be under the jurisdiction of a single authority, and that the sanitary authority is the appropriate one for that purpose. Indeed the advantage of placing in the same hands the supervision of vaccination and of the other measures designed to prevent the spread of disease are so great and so obvious that the proposal to do so deserves most serious consideration. Under present arrangements, however, such a proposal raises very great difficulties. Whilst in England and Wales there are only 648 vaccination authorities, the sanitary authorities exceed 1,700 in number. Moreover, whereas in some cases a borough (the council of which is the sanitary authority) comprises parts of several unions, in other cases a single union contains within it many sanitary authorities. For example, the Borough of Bristol includes the whole of one union and parts of two other unions. On the other hand the Huddersfield and Halifax unions contain no less than 25 and 19 urban sanitary districts respectively. Many other instances might be cited to show that it would be impracticable to vest the sanitary and vaccination duties in all cases in a single local authority without a complete recasting of our present areas of local administration. We are not in a position to devise a scheme which would accomplish either wholly or partially the desired result. At the same time we fully recognise the importance of achieving it as far as possible and we should regard with favour such changes as would render the amalgamation of the vaccination and sanitary authorities feasible, or indeed any steps taken in that direction even although they should only partially effect the object in view.

(*E.*) *As to whether any alterations should be made in the arrangements and proceedings for securing the performance of vaccinations, and, in particular, in those provisions of the Vaccination Acts with respect to prosecutions for non-compliance with the Law.*

509. From the views which we have expressed on the subject of vaccination, and on the absence of proof that any practical alternative exists which could be relied on to accomplish the same results if vaccination fell into disuse, it follows that we are of opinion that the State ought to continue to promote the vaccination of the people.

Nor are we prepared to recommend that the State should cease to require vaccination, and trust entirely to a voluntary adoption of the practice.

510. It will be well at the outset of our discussion of this subject to advert to the nature of the compulsion at present employed, to secure compliance with the law requiring that children should be vaccinated within a limited time after their birth.

When vaccination is spoken of as "compulsory," it is only meant that, in case a child is not vaccinated as prescribed by law, a pecuniary penalty is imposed which may be followed by distress and imprisonment. The liability to this penalty no doubt in many cases leads to vaccination, where it would otherwise be neglected; but, whether the penalty be enforced once or repeatedly it does not compel vaccination in all cases. If a parent is content to pay the penalty his child remains unvaccinated; there have been not a few cases in which repeated penalties have been thus paid. Vaccination could be made really compulsory only by taking the child from the parent and vaccinating it against his will, if he would not himself procure or consent to its vaccination. It is necessary to bear this distinctly in mind in considering the modifications of the present law which have been proposed. There may be some who would consider it both justifiable and expedient for the State thus to take the matter into its own hands, and effectually ensure the vaccination of the entire population. We do not stop to inquire whether it would be justified in adopting such a method, for we are satisfied that no such measure, if proposed, would have any chance of acceptance; indeed, few even of the most ardent advocates of vaccination have hitherto made such a proposal. Nor, again, do we think that a proposal to substitute for the pecuniary penalty now imposed a more stringent form of punishment, such as imprisonment, would have any greater chance of acceptance.

511. If, then, the only kind of compulsion available is to attach some pecuniary penalty to the neglect of vaccination, the question to be determined is what form of law, based on penal provisions of this description, will secure the largest number of vaccinated persons. That this is the question to be solved has, we think, sometimes been lost sight of. In our Fifth Report we recommended that repeated penalties should no longer be enforced. Our proposal has been subjected to criticism on the ground that it would enable a person to break the law, and to purchase immunity by the payment of a single penalty. But there is no difference in principle whether immunity can be purchased by the payment of one or of several penalties. If the cases in which vaccination was omitted would be less in number, supposing one penalty only were enforced instead of many, the end which the Legislature sought to accomplish in enacting the compulsory vaccination law would be better attained. To secure that vaccination should be as widespread as possible is, we think, the object to be kept primarily in view. When an answer has been found to the question, what scheme which is within practicable limits would best conduce to that end, the form which legislation should take will, in our opinion, have been ascertained.

512. We have alluded to the mode in which pressure is at present exerted to secure vaccination; we must now direct attention to the machinery by which the law is enforced.

It is for the local authorities to put the law in motion. In England and Wales the guardians have been in the main an elected body, necessarily reflecting the views of those by whose votes they obtain their office. In some districts guardians have been elected from time to time solely because they have pledged themselves not to prosecute those who fail to have their children vaccinated. The enactments under which the guardians are the authority to enforce the vaccination laws contain no provision dealing with the case in which they neglect or refuse to do so. By a statutory Order made by the Local Government Board the duty of enforcing these laws has been cast upon the Guardians, and in the case of the Guardians of the Keighley Union a *mandamus* was issued by the Court of Queen's Bench commanding them to perform this duty. In default of obedience they were committed to prison. After a short incarceration they were let out on bail. When subsequently brought before the Court to answer for their contempt, they were released on entering into their own recognizances to come up for judgment when called upon. By the terms of the recognizance they were bound while guardians to do nothing in disobedience to the Vaccination Acts or to cause their operation to be in any way disturbed. The proceeding proved, however, quite ineffectual so far as vaccination was concerned. The same course was pursued afterwards as before. There is no process open for constraining guardians to enforce the vaccination law except a *mandamus* resulting in their committal to prison in case they refuse to obey the command of the court. Experience has shown that when the guardians represent a local community opposed to vaccination this method of putting pressure upon them is inoperative to promote it.

513. We were anxious to learn to what extent the guardians in England and Wales had ceased to put the law requiring the vaccination of children in force. We accordingly made inquiry of the guardians throughout the country. Answers were received from 620 out of the 648 Unions. We found that the law was not being enforced in 122 out of these 620 districts; in 46 of the 122, however, the guardians based their action upon the fact that a Royal Commission had been appointed to inquire into the subject of vaccination and had not yet reported.

514. The question then naturally arises whether the institution of proceedings against those who do not procure the vaccination of their children as required by law should be transferred from the Guardians to some other authority, either universally or where the guardians refuse to prosecute. If such a change were made, the only alternatives would seem to be either to transfer the duty to some local authority having jurisdiction over a wider area, such as the County Council, or to vest it in the Local Government Board. We do not think it would be feasible to impose on the county councils the duty of enforcing the vaccination laws in cases where the local authorities neglected to do so. Such an arrangement would have the effect of bringing these councils at once into acute conflict with other local authorities exercising jurisdiction in different districts within the ambit of the several counties, and the practical difficulties involved in the scheme would obviously be great. If, then, any transfer to the county councils of the duty now incumbent on the guardians or other local bodies were deemed expedient, we think it would be found requisite to transfer the duty altogether. It is not certain that a change of the nature we are considering would lead on the whole to a more complete enforcement of the law relating to vaccination. In some cases it might do so; but, on the other hand, it might happen that the majority of a county council would be elected to support an anti-vaccination policy, in which case the area within which the vaccination laws were not enforced, might be extended. It is to be anticipated, too, that any proposal to cast the duty of enforcing vaccination upon county councils would encounter serious opposition.

515. The other alternative would be to vest the duty of prosecuting in the Local Government Board. It may be that it is already empowered to cause prosecutions to be instituted against defaulters. Article 17 of the Local Government Board Order of October 1874 provides that the vaccination officer of any district shall take any such proceedings as may be necessary under the Vaccination Acts in any case in which the Local Government Board may direct him to do so. But if this Article confers the power to direct a vaccination officer to prosecute, notwithstanding that the guardians, whose officer he is, have resolved not to enforce vaccination penalties, no such power has ever been exercised in spite of the fact that for years past the guardians in many districts have allowed the compulsory vaccination laws to fall into abeyance. Under these circumstances it is, to say the least, very doubtful whether the Local Government Board would without direct parliamentary sanction, even if they have the power to do so, adopt the new departure of overriding the action of the local authorities, to say nothing of the practical difficulties which such a course would present. It would not, in our opinion, be practicable altogether to withdraw the duty of proceeding against defaulters from local authorities and to vest it in the Local Government Board. If that Board is to discharge the duty at all, its intervention would have to be confined to cases in which the local authority failed to enforce the law. Even if the duty of the Local Government Board were thus limited the proposal might not improbably have to encounter the resistance not only of those who were opposed to compulsory vaccination, but of some who, though having no leaning in that direction, were keenly sensitive to any interference by a Government department with local authorities. The situation is by no means the same as if from the outset the law had been enforced by the Local Government Board. Moreover, it does not seem certain that, if the scheme we have been discussing were embodied in an Act of Parliament, it would achieve the desired end. In some parts of the country the action of the central body would most certainly be obstinately and even violently resisted, and that resistance would probably obtain the aid and sympathy of many who regarded the question of vaccination with indifference. The result might well be not more but less vaccination than at present.

516. Before proceeding to state the conclusions which we draw from the considerations to which we have been adverting, it is desirable to point out that it is only within a limited area in England and Wales that vaccination has fallen into more or less

disuse. The vaccination of the great majority of children is secured, where the practice is not voluntarily adopted, by the penalty to which the law subjects those who neglect to have their children vaccinated. It is not found necessary, in a large number of cases, to put the law in motion or to enforce the penalty; the mere liability to it is in general sufficient. It is worth giving the figures from a return presented to the House of Commons in 1890. It shows that, since July 1879 to the date up to which the return was made, the number of persons fined in England and Wales for breach of the vaccination laws was 11,408. Of these 115 were imprisoned. The date up to which the return extends is not stated, but it covers a period of at least ten years; so that the average number of fines per annum was about 1,100.

517. The necessity of proceeding to enforce a penalty, or at all events repeated penalties, arises for the most part in cases where the parent objects to have his child vaccinated, and not in cases of mere neglect or indifference, It is important to consider how it has come about that whereas in many parts of the country there is no serious objection to vaccination, in other places the objection is so acute and widespread that the opponents of the practice are enabled to elect guardians pledged to abstain from enforcing it. We believe that it has largely arisen from the attempt to compel parents to vaccinate their children who conscientiously believe that vaccination is of little or no advantage as a protection against small-pox, and that it involves a serious risk of injury to the health of the vaccinated child. Symptoms of injury following vaccination, and really or apparently connected with it, have occurred in the case, it may be, of an elder child of the same parent, or in the case of a neighbour's child; this immediately arouses hostility to vaccination, and induces the parent to resolve that his child shall remain unvaccinated. If the attempt be made to compel a parent, in this attitude of mind, to have his child vaccinated, it meets with determined opposition, and, where the penalty is repeated, the hostility is often intensified without any progress being made towards the vaccination of the child. Such a parent has often become a focus of hostility to the vaccination laws; his neighbours and friends take his side; he is regarded as a martyr; and he and they frequently become active agitators against the vaccination laws. There are, indeed, a central association and local associations which advocate the abolition of compulsory vaccination, and denounce the practice altogether; but it is local circumstances, such as we have described, which stimulate the creation of these local associations and give them their vitality, and which add to the force of the central association. It is often said that the opposition to vaccination is the work of agitators. This may be true; but the agitation, though it may be afterwards intensified from without, in our belief has its origin, almost invariably, in a particular locality. It is this, we, think, which accounts for the phenomena to which we have called attention that the acute opposition to vaccination is confined to a limited number of localities, and that it seems usually to spread from a local centre.

518. In Scotland the vaccination laws have encountered little opposition, the great majority of the children born are vaccinated. The enforcement of the law is there in the hands of the parochial boards. Some of these boards would seem to have exercised a discretion in subjecting defaulters to prosecution, though the exercise of this discretion does not appear to have been in strict accordance with the law. They have been in the habit of omitting from the list sent to the vaccination officer those whose names appeared on the registrar's list, but who had been already prosecuted, sothat no further proceedings were taken against them. The practice of the parochial boards in this respect has not been uniform. We have no means of judging to what extent this discretion has been exercised, but we gather that it has been so to a considerable extent. The Scotch vaccination law and its methods of procedure, no doubt, tend to discriminate in a manner unknown in this country between the cases in which the failure to procure vaccination was due to hostility to the practice on the part of the parent, and those which resulted from mere neglect or indifference. In England and Wales, where a parent does not procure the vaccination of a child by a private medical practitioner or take it to a vaccination station for the performance of the operation by a public vaccinator, this may equally arise from objection to vaccination or from neglect or indifference. There is nothing tending to show what influence has led to the failure to procure vaccination. In Scotland the case is different. If a child is not vaccinated within the time specified in the notice received from the parochial board, the official vaccinator attends at the abode of the parent prepared then and there to vaccinate the child, unless consent to do so is refused. Its vaccination is therefore at once secured, unless the parent interposes a refusal, or the official vaccinator sees grounds, either on account

of the condition of the child or of local circumstances, to postpone the operation. The reason given by the parent for a refusal to permit vaccination is embodied in a certificate, and is thus in all cases recorded.

The statements we have made refer to the condition of things existing until 1894, when the Local Government Act was passed. The duties and powers of the parochial boards were by that Act transferred to the district councils, and the duties and powers of the Board of Supervision to the Local Government Board.

519. The details relating to defaulters in one half year which were furnished us by Mr. Skelton are worth giving with some particularity. The half year in question is that ending the 31st of December 1892. The number of persons returned as defaulters is 6,613. Of these there were returned as defaulters for the first time 4,327, so that the balance of upwards of 2,000 was brought forward from previous years. The number of children who had been vaccinated by the official vaccinator since the date of the list (prior to April 1893, when Mr. Skelton's evidence was given) was 1,006. The number of children since the date of the list vaccinated by other medical practitioners was 1,604. The number not vaccinated because they had died or left the parish or could not be found was 1,833, and because of postponement certificates, 1,178. The balance of 992 was made up as follows:—(*a*) children vaccinated but the certificates not transmitted, 207; (*b*) previous successful vaccination, 44; (*c*) insusceptible, 18; (*d*) undisposed of, cases being attended to (these had not been completed, the vaccinator, not being in a position to state whether vaccination had been successful or not), 125; (*e*) isolated position of houses in severe weather making it difficult for the vaccinator to carry it out, 161; (*f*) illness or omission on the part of the inspector of the poor, 66, (*g*) postponed on account of epidemics in the locality, 46; (*h*) delay pending the report of the Royal Commission on Vaccination, 10; (*i*) refusal of parents, 50; (*k*) delay of parents, 35; (*l*) on account of ill-health, 39; (*m*) unaccounted for entirely, no reason given, 194.

520. The number of prosecutions during the half year was 22 only. Of these 7 were for failure to transmit the certificate within the specified period, and 15 for refusal to allow the child to be vaccinated. Of those 15 there were 10 who were prosecuted for the first time, 4 who were prosecuted for the second time, and 1 who was prosecuted for the fifth time. These figures are instructive. In view of those quoted in the preceding paragraph, the number of prosecutions appears remarkably small, and it does not seem possible to doubt that the practice of the different parochial boards must have varied greatly.

The figures above given relate to the same half-year as that to which the figures in the preceding paragraph relate, and would have reference to some cases which had occurred in the previous half-year. The figures for the subsequent half-year, when some of the cases of default referred to in that paragraph would be dealt with, are as follows:—The number of prosecutions during the half-year was 11 only; of these 4 were for failure to transmit the certificate, and 7 for refusal to allow the child to be vaccinated.

521. We are now in a position to state the reasons which led us to recommend that repeated penalties should no longer be enforced; indeed they will be apparent from what we have aready said.

We do not doubt that the fact that penalties may be repeated secures in some cases the vaccination of children who would otherwise remain unvaccinated; but we believe that the irritation which these repeated prosecutions create, when applied in the case of those who honestly object to have their children vaccinated, and the agitation and active propaganda of anti-vaccination views which they foster in such cases, tend so greatly to a disuse of the practice, in the district where such occurrences take place, that in the result the number of children vaccinated is less than it would have been had the power of repeated prosecution never existed or been exercised. This seems to us to be the crucial question. A law severe in its terms, and enforced with great stringency, may be less effectual for its purpose than one of less severity and which is put in force less uncompromisingly. When this is the case it cannot be doubted that the law which appears less severe is really the more effective. The ultimate object of the law must be kept in view. The penalty was not designed to punish a parent who may be considered misguided in his views and unwise in his action, but to secure the vaccination of the people. If a law less severe, or administered with less stringency, would better secure this end, that seems to us conclusive in its favour.

522. If, then, we cannot look with any certainty to a change of the authority whose duty it is to enforce the law as a means of securing vaccination in those districts where it has already fallen into disuse, it obviously follows that every endeavour should be made so to frame and to administer the law that opposition to vaccination should not spread to other districts, and that it should cease or diminish in those parts of the country where it at present prevails.

It is to be hoped that our Report will stimulate belief in the efficacy of vaccination, that it will remove some misapprehensions and reassure some who take an exaggerated view of the risks connected with the operation, as well as lead to a more ready enforcement of the law by local authorities.

523. Why, it is asked, should not vaccination cease to be compulsory altogether, and be left to the free choice of parents? If no penalty were attached to the failure to vaccinate, it is, we think, certain that a large number of children would remain unvaccinated from mere neglect on the part of their parents, or indisposition to incur the trouble involved, and not because they thought it better in the interest of their children. This appears to us to be a complete answer to the question. If we be right in the conclusions which we have expressed on the subject of vaccination, it is better for the child, and better for the community, that it should be vaccinated than that it should remain unvaccinated. A parent can have no inherent right under the circumstances to which we have alluded to prevent or neglect its vaccination. The difficulty arises where the parent abstains from procuring the vaccination of the child because he believes it will be detrimental to its interests. We do not intend to discuss the abstract question whether the State is entitled in such circumstances to compel the parent, in spite of this conviction, to see that his child is vaccinated; we will assume for the purpose of our argument that it is so entitled. This leaves untouched the question whether, on the whole, such a course conduces to a better vaccinated condition of the people. We think that ardent advocates of vaccination have not always borne in mind the practical consequences of an attempt to enforce the law in such cases. They have maintained that no one has a right to set up his judgment against that of the community embodied in the statute law, and to refuse in consequence to render that law his obedience; they have, therefore, opposed any relaxation of the laws relating to vaccination, assuming that because in particular instances it might lead to children remaining unvaccinated who would otherwise be vaccinated, it must necessarily result in a diminished number of vaccinations. We believe that this assumption is not well founded. It has been apparently forgotten that under the existing law a penalty, or even repeated penalties, can be paid without difficulty by a man only moderately well-to-do, and that a poorer man will constantly pay, or suffer a distress of his goods, or go to prison, rather than allow his child to be vaccinated. We think these ardent advocates have not always been the wisest friends of vaccination, and that there would have been more vaccinated persons if the law had been enforced with more discretion.

524. After careful consideration and much study of the subject, we have arrived at the conclusion that it would conduce to increased vaccination if a scheme could be devised which would preclude the attempt (so often a vain one) to compel those who are honestly opposed to the practice to submit their children to vaccination, and, at the same time, leave the law to operate, as at present, to prevent children remaining unvaccinated owing to the neglect or indifference of the parent. When we speak of an honest opposition to the practice, we intend to confine our remarks to cases in which the objection is to the operation itself, and to exclude cases in which the objection arises merely from an indisposition to incur the trouble involved. We do not think such a scheme impossible.

525. It must of course be a necessary condition of a scheme of this description that it should be such as would prevent an objection to the practice being alleged merely as an excuse to save the trouble connected with the vaccination of the child. We may give the following as examples of the methods which might be adopted. It might be provided that if a parent attended before the local authority and satisfied them that he entertained such an objection, no proceedings should be taken against him. Or, again, a statutory declaration to that effect before any one now authorised to take such declaration, or some other specified official or officials, might be made a bar to proceedings. We do not think it would be any real gain to parents who had no conviction that the vaccination of their children was calculated to do mischief, to take either of these steps rather than submit them to the operation.

526. It is in England that the point we have been recently discussing is of most practical importance, but if our suggestion were adopted the change should, of course, be made in all parts of the United Kingdom.

527. We are quite conscious that the proposal we have made will be regarded by some as a retrograde step in the cause of vaccination. We do not believe that it would prove to be so in practice. Too blind a confidence is sometimes reposed in the power of an Act of Parliament. It is thought that if the law be only sufficiently stringent and inflexibly enforced the desired end is sure to be attained. There is, however, abundant experience to the contrary. When that which the law enjoins runs counter to the convictions or prejudices of many members of the community it is not easy to secure obedience to it. And when it imposes a duty on parents the performance of which they, honestly, however erroneously, regard as seriously prejudicial to their children, the very attempt to compel obedience may defeat the object of the legislation.

At the same time we think it would be well to make the change a temporary one in the first instance, say, for a period of five years, and that in the meantime its effects should be carefully watched.

528. Whatever diversity of opinion there may be on the point just discussed, there can be no doubt that every effort should be made to remove the causes which now render vaccination burdensome and tend to its discouragement, and that such changes in our vaccination system should be made as would be calculated to promote vaccination and diminish the number of cases in which the practice is neglected.

529. We have no hesitation in expressing the opinion that the Scotch system is in some respects, to which we have called attention, superior to that prevailing in the other parts of the United Kingdom. Its great merit lies in this, that the defaulters are sought out at their own homes by the official vaccinator and then and there vaccinated by him, unless the parent objects or circumstances render postponement desirable. There is obviously a great difference between this system and one in which the vaccinator does not present himself at the child's home, but the child must be taken by the parent to a vaccination station and when the next step after default is a prosecution. We cannot doubt that the former is far better calculated than the latter to secure the vaccination of the people. On the other hand it appears to us a defect in the Scotch plan that gratuitous vaccination can only be procured for those who are not pauper children by making default, in other words, by failing to obey the law. For this reason we think it would not be wise to adopt that plan in England and Wales without modification. We think that where a certificate of successful vaccination is not received within the prescribed time a notice should be served upon the parent that a public vaccinator will attend on a day named for the purpose of vaccinating the child, unless the operation has been already performed, and that the only offence rendering the parent liable to prosecution should be the refusal to permit the child to be vaccinated by the public vaccinator when he attends for that purpose. The adoption of such a scheme would render the burden much less than it is where the child has to be taken to a public station, not only for the purpose of vaccination, but again at the end of a week for inspection. The vaccination and inspection would both take place at home. It is not only by rendering vaccination less burdensome that this would be an improvement, it would also, as we have already pointed out, tend to diminish risks of injury which arise when a child is conveyed twice to a public station, and which would be absent if the vaccination and inspection always took place at home. Moreover, the vaccination would be more certain to be postponed when the condition of the child or local or family circumstances make this course desirable. This again would diminish the risk attending vaccination. Further, the proposed change would render it easier to introduce the requirement, already alluded to, that the progress of the vaccination should be more carefully watched than it is at present, and any mistakes made in the treatment of the vaccination vesicles would be likely to be more early discovered and more readily remedied.

530. We think it would tend to promote vaccination if every duly qualified medical man who vaccinated a child successfully were entitled to the fee which is now paid only to the public vaccinator. We are aware that there is evidence tending to show that in England and Wales vaccination has been, speaking generally, more efficiently performed by public vaccinators than by other medical men. But the experience of Scotland, where only a minority of the vaccinated are dealt with by official vaccinators, shows that such a system may be a satisfactory one. Safeguards might be provided against inefficient vaccination. The fee should only be allowed in cases where the

certificate showed that the child had been vaccinated in accordance with the rules prescribed by the Local Government Board. And if every duly qualified practitioner who vaccinated a child successfully could claim the appointed fee, it could properly and ought, we think, to be made a condition that all children so vaccinated should be liable to inspection, and that the fee should not be allowed when the examination did not appear to have been performed in accordance with the prescribed rules. It would not, of course, be necessary to make such an inspection in every case; a limited number of test cases would suffice. The liability to inspection would prevent abuse, and under proper regulations we think the system might be an improvement on any at present existing.

531. We have already said that in our opinion the State is bound to see that a supply of calf lymph is within the reach of every vaccinator. Though this recommendation has been dictated by other reasons, its importance in connexion with the alteration in our vaccination system which we are now considering is apparent. It would at all events go far to secure that any defect in vaccination should not result from imperfection in the lymph employed.

532. The change which we propose in our vaccination system would no doubt render it somewhat more costly,* but the difference would not be very great, and, in our

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**Note.*—*In connexion with this, it may be well to indicate the approximate annual cost at the present time in England and Wales of the practice of vaccination, so far as that cost is borne by the public funds.*

Out of the sums received from Poor Rates and in aid of Poor Rates, the expenditure for vaccination fees and expenses during the last ten years for which the figures are available was as follows :—

Year ending Lady day :	*Expenditure :*	*Year ending Lady-day :*	*Expenditure :*
	£		£
1886	*93,475*	*1891*	*84,295*
1887	*92,116*	*1892*	*83,146*
1888	*90,487*	*1893*	*83,709*
1889	*91,254*	*1894*	*87,981*
1890	*85,606*	*1895*	*82,961*

Out of sums voted by Parliament or, more recently, out of county funds and charged to the Exchequer Contribution Account, there has been the following expenditure in respect of awards to Public Vaccinators :—

Year :	*Amount of awards to Public Vaccinators in Unions inspected during the years specified in the last column :*	*Year :*	*Amount of awards to Public Vaccinators in Unions inspected during the years specified in the last column :*
	£		£
1885	*17,687*	*1890*	*15,638*
1886	*18,964*	*1891*	*13,625*
1887	*17,313*	*1892*	*15,289*
1888	*17,974*	*1893*	*14,286*
1889	*15,042*	*1894*	*12,171*

The cost of the National Vaccine Establishment, which is a department of the Local Government Board, has been as follows :—

Year :	*Cost :*	*Year :*	*Cost :*
	£		£
1885–6	*3,635*	*1890–1*	*3,263*
1886–7	*3,537*	*1891–2*	*3,193*
1887–8	*3,385*	*1892–3*	*3,081*
1888–9	*3,453*	*1893–4*	*3,019*
1889–90	*3,188*	*1894–5*	*3,205*

And there has also been, of course, the cost of the administration of the Vaccination Acts by the Local Government Board, the amount of which cannot be accurately stated.

judgment, no consideration of cost ought to be allowed to stand in the way of any improvement which would render the operation less burdensome or diminish its risk. It is only fair to demand this if vaccination is to remain compulsory. In this connexion we may observe that the public vaccinator ought, in our opinion, to be under an obligation to afford medical attendance without cost to the parent in all cases in which the vaccination does not run an ordinary course, and owing to supervening illness such attendance becomes necessary. Whether the fee paid in respect of vaccination should be fixed at such an amount as to cover this extra attendance in the exceptional cases in which it would be requisite, or whether it should be the subject of special compensation, is a matter of detail on which the Local Government Board is in a better position to form an opinion than we can be. Inasmuch as compulsory vaccination is justified on the ground that it is not a matter which concerns alone either the parent or the vaccinated child, we think a provision such as we have indicated would be both just and reasonable.

533. We have already adverted to the importance which we attach to re-vaccination. It has been suggested that the operation should be made compulsory by law. We are quite alive to the protective value of general re-vaccination. At the same time we are not insensible of the difficulties necessarily involved in rendering it compulsory. It is, comparatively speaking, easy in the case of infants to ascertain whether the law requiring vaccination has been complied with. The constant movement of the population would render it much more difficult to ascertain whether at the more advanced age at which it would become applicable, a law providing for compulsory re-vaccination had been observed. Again, it is impossible to leave out of sight the effect that such an extension of the present compulsory law might have in intensifying hostility, where it at present exists, and even in extending its area; though if our recommendations, especially that which exempts from penalty those who honestly object to the practice, were adopted this objection would be much diminished. After full consideration of the question we are, however, deterred by the considerations to which we have adverted from proposing that re-vaccination should be made compulsory. At the same time in view of the great importance of re-vaccination we think it should be in every way encouraged. If an adequate fee were allowed in every case of successful re-vaccination, by whatever medical man it was performed, we think there would probably be a large extension of the practice. We think steps should be taken to impress on parents the importance of having their children re-vaccinated not later than at the age of twelve years. We recommend further that when small-pox shows signs of becoming epidemic special facilities should be afforded both for vaccination and re-vaccination.

534. We think that notification of small-pox should everywhere be compulsory, and, whenever the disease showed a tendency to become epidemic, a notice should be served by the sanitary authority upon all persons in the neighbourhood who would be likely to come within the reach of contagion, urging them to submit to vaccination or re-vaccination, as the case might be, if they had not been recently successfully vaccinated or re-vaccinated; and attention should be called to the facilities afforded for their doing so. Attention should also be called to the importance of avoiding contact with persons suffering from the disease, or coming into proximity to them, and of avoiding contact with any person or thing which may have become infected. It is important to notice that, even where vaccination has been neglected, there is great readiness to submit to it in the presence of a threatened epidemic; a large number of vaccinations are then obtained willingly and without opposition. Whenever a sanitary authority has received notification of a case of small-pox, we think the fact should be at once communicated to the vaccination authority of the district in which the case of the disease has occurred.

535. We desire to call attention again to the recommendation, which we made in our fifth interim report, that persons committed to prison by reason of the non-payment of penalties imposed under the vaccination laws, should no longer be treated as criminals. We stated in that report our reasons for this recommendation, to which we still adhere. If, however, the changes in the compulsory provisions of the vaccination laws which we have suggested were adopted, the matter would lose much of its importance.

536. We have had the misfortune to lose by death several of our colleagues. Mr. Bradlaugh died at an early stage in the inquiry, and was replaced as a member of the Commission by Mr. Bright. Sir William Savory and Dr. Bristowe died at a later period, and their places have not been filled. We are deeply sensible of the valuable assistance in the preparation of this Report of which death has thus deprived us.

537. We cannot conclude our labours without expressing our sense of the great assistance we have derived from the zeal and ability with which our Secretary, Mr. Ince, has discharged his duties.

All which we humbly submit for Your Majesty's gracious consideration.

(Signed) HERSCHELL.
JAMES PAGET.
CHARLES DALRYMPLE.
W. GUYER HUNTER.
EDWIN H. GALSWORTHY.
JOHN S. DUGDALE.
M. FOSTER.
JONATHAN HUTCHINSON.
FREDERICK MEADOWS WHITE.
SAM. WHITBREAD.
JOHN A. BRIGHT.

BRET INCE,
Secretary.

August 1896.

The undersigned do not find themselves able to go so far in recommending relaxation of the law as is implied in paragraphs 524, 525, 526, and 527. We think that in all cases in which a parent or guardian refuses to allow vaccination, the person so refusing should be summoned before a magistrate, as at present, and that the only change made should be to permit the magistrate to accept a sworn deposition of conscientious objection, and to abstain from the infliction of a fine.

We are also of opinion that, in spite of the difficulties as set forth in paragraph 533, a second vaccination at the age of twelve ought to be made compulsory.

W. GUYER HUNTER.
JONATHAN HUTCHINSON.

We the undersigned desire to express our dissent from the proposal to retain in any form compulsory vaccination. (Paragraphs 509, 511, 522, 523, 524, 525, 529.)

We cordially concur in the recommendation that conscientious objection to vaccination should be respected. The objection that mere negligence or unwillingness on the part of parents to take trouble might keep many children from being vaccinated would be largely, if not wholly, removed by the adoption of the Scotch system of offering vaccination at the home of the child, and by providing for medical treatment of any untoward results which may arise.

We therefore think that the modified form of compulsion recommended by our colleagues is unnecessary and that in practice it could not be carried out.

The hostility which compulsion has evoked in the past toward the practice of vaccination is fully acknowledged in the Report. In our opinion the retention of compulsion in any form will in the future cause irritation and hostility of the same kind.

The right of the parent on grounds of conscience to refuse vaccination for his child being conceded, and the offer of vaccination under improved conditions being made at the home of the child, it would in our opinion be best to leave the parent free to accept or reject this offer.

SAM. WHITBREAD.
JOHN A. BRIGHT.
W. J. COLLINS.*
J. ALLANSON PICTON.*

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* *Note.—Dr. Collins and Mr. Picton sign the above note of reservation, though they have not signed the Report. A statement of their grounds of dissent from the Report will be found on page* 156 *and following pages.*

APPENDIX I.

Detailed discussion by the Commission of:—(A.) The "Variolous Test"; and (B.) Woodville's cases.

(A.)—*The "Variolous Test."* (*See* §§ 13–17 *of Report.*)

In the practice of inoculation for the small-pox it was observed in successful and normal cases that on the 2nd and 3rd day, the part of the skin into which the small-pox matter had been inserted became red and hard, that is to say, inflamed. On the 4th day the beginning of a vesicle might be detected. On the following days the vesicle became more distinct, and surrounded by an area of redness, the so-called efflorescence.

On the 6th day some pain in the axilla was usually felt, and on the 7th or the 8th day, general disturbances constituting the "eruptive fever" or "fever of invasion" made their appearance. This lasted some two or three days, subsiding soon after the appearance, towards the end of the 10th or on the 11th day of pustules on the surface of the body other than the seat of inoculation. This eruption of pustules usually lasted about three days. When these pustules began to suppurate, as they usually did on the 13th or 14th day, a secondary fever, whose intensity was greater or less according as the pustules were many or few, was observed.

The eruptive fever was regarded as an indication, the axillary pain being a premonitory symptom, that the virus had "affected the system." The changes taking place previous to the eruptive fever were held to be purely local; the matter inserted produced in the inoculated spot a series of events, but these were limited to seat of inoculation, and did not spread beyond. So soon as the local changes caused by the virus began to produce effects in the body at large, those effects were revealed, first, by the eruptive fever, and later on by the eruption of pustules. And it was held that immunity towards small-pox was only secured when the "system," the body at large, had thus been "affected;" the mere local changes were not sufficient to produce immunity.

When the pustules made their appearance in parts of the body distant from the inoculated spot, even though they might be few, no doubt was entertained but that the system had been affected and immunity secured. But at times no eruptive pustules at all made their appearance, and the evidence of the system being affected was less conclusive.

So far as can be judged from the writings of Sutton and Dimsdale, these inoculators (in cases rendered doubtful by the absence of eruptive pustules) trusted to the eruptive fever as the sign that the system had been affected. And the same may be said of Gatti, for though he has been accused (Bromfield, *Thoughts*, &c., p. 44) of "giving "the disorder" (*i.e.*, inoculating) "without the sensible effect of either fever or "eruption," his own writings do not bear this out; he says (*Nouvelles Réflexions*, 1767, p. 91), "the third period is marked by the fever," and again (p. 94) that the fever "is the sole constant symptom of the action of the virus on the total of the animal "economy"; and, again, in treating of the fever attendant on the suppuration of the eruptive pustules which he insists is not the special and immediate effect of the variolous virus, he points out that when the pustules are few the suppurative fever is slight, and that when there are no pustules it is absent, and "the malady is finished at "the same instant that *the eruptive fever has ceased.*"

Of course the symptoms of the eruptive fever formed, even at the best, a far less definite sign of the system being affected than did the eruption of pustules; and it is highly probable that inoculators, in cases where eruptive pustules were absent, may have at times mistaken a feverish disorder of intercalated origin for the specific eruptive fever. On the other hand, anomalous cases occurred in which the signs of the "system "being affected" did not include a distinct fever, that is to say, a rise of the temperature of the body. Dimsdale ("*The Present Method of Inoculating*," 6th ed. 1772, p. 47, et seq.) dwells on and gives the details of several of such cases. He speaks of them as instances of "a short way of having the distemper," and insists on the variety and irregularity of the symptoms manifested by such cases. Briefly put, in such cases the local effects advance prematurely, the whole malady being, sometimes, over in a week; there is no eruption, or a slight and imperfect one, and the signs of "the system being affected" are limited to chilliness, slight pains, giddiness, and a slight headache, "sometimes attended with a feverish heat, but often without any." Elsewhere he speaks of a peculiar offensive smell of the breath as being specially diagnostic of the system being affected. When Dimsdale first met with these cases he doubted whether the disease had been really taken, but, in a manner which will presently be described, satisfied himself that it had. He goes on to say that his subsequent experience enabled him from the early appearances of the local effects "to foretell in two or three "days after the operation when the disease will pass in this slight way."

Thus the inoculator was not satisfied that the disease had really been given unless the local effects were accompanied by an eruption of pustules, or, failing them, by an eruptive fever, or, at least, by certain symptoms which he accepted as signs that the system had been affected.

When an inoculator met with a case in which from an absence of eruptive pustules, or from the symptoms of the eruptive fever being ill defined, or from the presence of other anomalous features, it seemed to him, or, indeed, to the patient, doubtful whether the disease had really been given, it was not an uncommon practice to repeat the inoculation. If the second inoculation failed, the result was taken as evidence that the first inoculation had really given the disease, and so conferred immunity; a conclusion sometimes further tested by a third inoculation, or even several in succession. If the second inoculation succeeded, that is produced a local pustule, with eruptive fever and an eruption of pustules, (the latter, however, being possibly absent), or at least with symptoms indicating that the system had been affected, the result was taken to show that the first inoculation had not really produced the disease. In this way the "variolous test" came into use as applied to small-pox inoculation, and was subsequently applied to cow-pox inoculation.

The experience of those inoculating persons who had previously had the small-pox, either by inoculation or in the natural way, disclosed that the local changes induced at the seat of inoculation might be various. Sometimes the wound healed immediately without any further effects at all. Sometimes inflammation set in, in some cases slight, in other cases considerable, and lasted for a variable time. Sometimes such an inflammation even when considerable was not specific, being merely what we should now call septic, and this, perhaps, was especially likely when the method of inoculation was by an incision, and not as in the improved method by a puncture. Sometimes the inflammation was specific, and a vesicle, passing on to a pustular condition, and then presenting the ordinary characters of a small-pox pustule, was formed. But in such cases, so long as there was no eruptive fever, or no special constitutional disturbances (it is needless to say so long as there was no eruption of pustules) it was concluded that, though the local changes might be regarded as specific, the existing immunity of the subject prevented the system being affected. All through the literature of inoculation a strong contrast is insisted on between the local changes, however specific, and the constitutional effects. On the one hand, local changes, of so distinctly a specific character that matter taken from the pustule produced "a perfect small-pox" when inoculated into other subjects, might go on in a subject suffering only from the local changes, and not having really the disease as shown by his afterwards "passing through the small-pox either in "the natural way or by inoculation" (Harrison, *Med. Phys. Jl., Vol. V., p.* 109). On the other hand, a subject rendered immune towards the disease by a previous attack, might have as the result of inoculation specific local changes giving rise to a pustule of specific small-pox nature, the immunity being shown by the absence of constitutional effects; in this relation is quoted the common experience that variolous pustules (due to accidental or intentional inoculation) might appear on small-pox nurses, who had previously had small-pox, pustules distinctly variolous, but entirely local and unaccompanied by any "affection of the system."

So far as can be judged from the literature of the subject, the ordinary experience of applying the variolous test to persons who had previously had small-pox, either by inoculation or in the natural way, was that the effects of the test inoculation were limited at most to a little inflammation, dying away in at longest a few days; the experience of a definite pustule being formed appears to have been rare. And

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in all cases the inoculators seem to have had little hesitation in deciding whether immunity was secured or not, being guided in the instances in which the local changes were considerable, by the presence or absence of symptoms indicating that the system had become affected.

The following passage from Dimsdale illustrates how, amid the varying results presented by the "variolous test," the inoculator saw his way to conclude whether the test showed immunity or no. The cases of "the short way of having the distemper" were subjected by Dimsdale, in his early experience, while he was as yet in doubt whether such cases had really had the malady or no, to the test on the one hand of severe exposure to contagion, and on the other hand of a second inoculation. He describes the results of the second inoculation thus—op. cit. pp. 50, 51:—

"Upon the second inoculation, however, the incised parts are commonly inflamed " for a day or two, just in the same manner as I have, in numerous instances, found " them to be as well in those who, though certain of having had the small-pox in the " natural way, have submitted to be inoculated merely for the experiment sake, that " the result might be observed, as in others, who, being doubtful whether they have " had it or not, have been inoculated, in order to be satisfied. But in all such cases " the parts soon became well; nor did any of those appearances which have been " described as the constant attendants on inoculation, as pain in the head, giddiness, " marks of infection on the arm, &c. ensue; nor can they ever be produced upon a " person who has had the small-pox before, either in the natural way or by inoculation; " and therefore it cannot with reason be suggested, that the patients, whom I suppose " to get through the disease in the very slight manner above described, may possibly " have had the small-pox unobserved in some former part of their lives."

That is to say, Dimsdale recognised a clear distinction between the maximum effects of inoculation applied to one who had had the small-pox before, the inoculation being then the variolous test, and the minimum obvious effects of inoculation consistent with its really giving the disease in one who had not had it before.

And the inoculators of cow-pox appear to have used the variolous test for immunity in the same way and under the same conceptions as did the old inoculators of small-pox.

(*B.*)—*Woodville's cases.* (*See* §§ 18–23 *of Report.*)

As we have stated in the body of our Report (§ 21): "Of the cases recorded by " Woodville in his Reports, the larger number, about three-fifths, presented an im-" portant and, as compared with Jenner's cases, a new feature, in that, in addition to " the changes taking place at the seat of inoculation and constituting what Woodville " called the 'cow-pox tumour,' which may here be spoken of as the 'vaccine vesicle,' " an eruption over the body of a greater or less number of pustules was observed. " These eruptive pustules occurred in the very first cases; of the seven cases inoculated " from the cow, four, and of the five inoculated from the dairymaid, four had such " pustules; and their appearance is recorded again and again in the series, down to " the case which appears last but one in the tabular statement forming part of the " Reports. Moreover an eruption of pustules is described in certain of the cases of " which accounts were published at about the same time by Pearson and many others. " In some of these cases the lymph used was supplied from the Small-pox Hospital by " Woodville or Pearson."

Those eruptive pustules (we may put on one side the cases in which an eruption of mere papules or pimples is recorded), possessed characters very different from those of the pustule, vesicle, tumour, or whatever it be called, which was produced at the seat of inoculation with the cow-pox matter. The latter presented certain features which distinguished it from the small-pox pustule, whether of inoculation or eruption. These distinctive features had of course to be learnt by the early vaccinators since they were dealing with a new subject. Jenner in his first case described the local appearances of inoculation with cow-pox matter as being much the same as those resulting from inoculation with small-pox; but he soon learnt to distinguish between the two, as did also Woodville, Pearson, and the rest. Woodville had certainly arrived at this knowledge by the time he wrote his Reports, for he there describes in detail the

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differences between the two, and probably had reached it in his early, if not in his very first cases. So sharply did he, at a later date, recognise the differences that he is able to speak of a small-pox pustule making its appearance within the margin of a cow-pox tumour.

The eruptive pustules, on the other hand, though they sometimes presented variations especially as regards suppuration, were, as a rule, identical in external characters with those of small-pox. And it may at once be admitted that they were actually the pustules of small-pox—were indications that the individual on whom they appeared was suffering from small-pox.

It is true that in the practice of vaccination, cases have from time to time occurred in which a general eruption of vesicles has been observed under circumstances which seem to preclude all possible coincident small-pox; in such cases the eruption appears to be a manifestation of the vaccine virus itself, and the cases are spoken of as those of "generalised vaccinia." The evidence available is not sufficient to show whether any of the eruptions recorded by Woodville and others were of this nature, and it may be taken for granted that at least the majority of cases were not, but were the eruptions of small-pox.

Woodville himself did not at first recognize that these eruptive pustules were those of small-pox; he for some time thought that, in spite of their likeness to those of small-pox and their unlikeness to the local cow-pox tumour, they were a natural part of the cow-pox disease; and under this idea he spoke of the cow-pox disease resulting from the inoculation of cow-pox matter, as being mild or severe according to the less or greater number of eruptive pustules, the mildest being those in which there were none at all; he used the terms commonly applied to the small-pox disease resulting from the inoculation of small-pox matter. Pearson also (*Med. Phys. Jl.*, vol. III., pp. 97 and 399) held similar views. But later on, Woodville certainly, and Pearson apparently as well as all the others arrived at the conclusion which Jenner had reached much earlier, that the pustules in question did not truly belong to cow-pox, but were really those of small-pox, and that the cases in which they occurred were cases of cow-pox and small-pox occurring together.

Woodville, during the period of his belief that the eruptive pustules were a natural part of the cow-pox, repeatedly made use for inoculation of matter taken from the eruptive pustules; even in the second series of cases recorded in his reports many instances of this occur. Such cases must be regarded as simply cases of inoculated small-pox, and they were apparently early recognized as such, for they were soon stopped; the cases by which the practice of vaccination was carried on and made its way were cases in which the matter used had been taken from the cow-pox tumour at the seat of inoculation.

It being granted that the cases in which eruptive pustules appeared were cases marked by the presence of small-pox, the question arises—How did the introduction of small-pox take place?

Before discussing this it will be useful to call to mind what is known concerning the behaviour of cow-pox and small-pox occurring at the same time on the same person. The evidence, which subsequent to the date of the events now being treated of has accumulated in support of the view that vaccination confers immunity towards small-pox, shows, at the same time and by similar lines of argument, that the establishment of immunity is not brought about until some days after the act of vaccination, after the introduction into the skin of the vaccine virus; and, further, that the effects of the nature of immunity towards small-pox, produced by vaccine, are dependent on the relations as to time of the introduction into the system of the two viruses. Thus it is admitted, that if vaccination be performed during the period of incubation of small-pox, that is to say, the period elapsing between the introduction by contagion into the system of the virus and the occurrence of the first symptoms, or at least after the third day of that incubation, the vaccine is powerless to confer immunity.

Similarly the evidence which showed that at a certain date after vaccination the attempt to produce small-pox by inoculation failed, also showed inoculation could bring about small-pox if done in the early days of vaccination, not later than the eighth or ninth day.

Hence, as has been repeatedly seen, under certain conditions small-pox and cow-pox may occur together at the same time in the same person.

Further, the evidence shows that the coincident presence in the body of the one disease does not affect the characters of the other, that, for instance, the coincident presence of small-pox does not modify the cow-pox, does not "variolate" the cow-pox, to use the word then employed. Thus, as Woodville himself points out (*Reports*, Crookshank, p. 148), if "on the same day a person be inoculated in one arm with the "matter of the cow-pox, and in the other with that of the small-pox, both tumours "preserve their respective characteristic appearances throughout the whole course of the "disease." Indeed he (*Observations*, p. 12) quotes the observation that if cow-pox and small-pox be inoculated at the same time into the same arm "with in an "inch of each other so that on the ninth day the same efflorescence becomes common "to both the local affections," matter from the cow-pox tumour produces the genuine vaccine disease:—"I am convinced the matter thus taken would not be more liable to "produce pustules or a less favourable disease than matter procured directly from the "cow."

Woodville, moreover, relates an experiment in which he inoculated a number of persons with matter consisting of equal parts of cow-pox and of small-pox matter well mixed together. "In more than half, the local affection distinctly assumed the "characters of the cow-pox; in the others it more resembled the small-pox, but in none "of them was there much indisposition or many pustules." It is doubtful whether any great stress ought to be laid on this experiment, but it may at least be taken to show that when the two kinds of matter are introduced into the same spot of the skin, they do not produce a hybrid local affection partaking of the characters of both, but give rise either to one or to the other. Whether the fact that in the greater number of cases the result was cow-pox shows that the cow-pox matter is prepotent, or "takes" more readily, need not be considered here; and the evidence just given precludes the view that the mild character of the small-pox was due to any action of the cow-pox. Nor has subsequent experience brought to light any evidence as to the possibility of any such hybrid disease; the presence in the body of the one virus modifies the effect of the other virus, but not the nature of the virus itself. It is true that, later on, in 1827, one Guillou (*Journal Général de Médicine*, XCVIII. p., 239), using lymph taken from a case of variola which had previously been vaccinated, and in which the disease appeared in the modified form known as "varioloid," not only produced local vesicles resembling those of vaccine and unaccompanied by eruptive pustules, but also carried the lymph through two other removes with the same results, and therefore maintained that the virus of the variola had, through the influence of the previous vaccination, been so affected as to assume the characters of the virus of vaccine. But a second attempt was not so successful, and his conclusions did not find acceptance. And indeed, while the details given of his cases by Guillou are insufficient to determine whether the local vesicles had truly vaccine characters, the absence of eruptive pustules may be regarded as being simply accidental, such an absence being possible though unusual.

The introduction of small-pox into Woodville's cases may have taken place in one of three ways:—

(i.) The cases either lived in the hospital or at least were brought to the hospital to be vaccinated, and so were much exposed to the contagion of small-pox. They might thus have caught small-pox at the hospital, or might indeed have caught it at their homes, and thus have suffered from natural or casual small-pox at the same time that they were undergoing cow-pox.

(ii.) In several cases the patient was inoculated for small-pox very early after vaccination, and thus, as has been shown above, may have had the two diseases together.

(iii.) The lancet used for introducing the cow-pox matter might have had adherent to it some small-pox matter left from previous use. Woodville states expressly in speaking of the first cases with pustules that the lancets supplied to him were said to be freshly ground; but experience has shown how easily in like cases error creeps in; even in these first cases, and probably still more in other later cases, where no special care is recorded as being taken, this means of the introduction of small-pox must be considered as *à priori* possible.

When we come to consider, in respect to individual cases, such facts as are recorded of their history, these do not seem adequate to form a sure judgment of the mode of introduction of the small-pox. In this relation a special interest attaches to the case of Collingridge, one of the seven cases vaccinated from the Gray's Inn Lane cow, and the one whose local tumour at the seat of inoculation supplied matter which was passed in succession through many persons and was the origin of much of the lymph used or distributed by Woodville. For if the small-pox from which Collingridge obviously suffered shortly after she was inoculated from the cow was due either to her being inoculated with small-pox on the fifth day after inoculation from the cow or to natural contagion, there is no reason whatever to doubt that the local effects produced by the inoculation from the cow was, as Woodville considered it, a cow-pox tumour; that is to say, a vaccine vesicle; that the matter—lymph—taken from this local tumour was veritable cow-pox matter, and that the series of cases through which it was propagated were cases of cow-pox. But, on the other hand, if Collingridge's small-pox were due to the lancet by means of which the cow-pox matter from the cow was inserted in her left arm, having, in spite of precautions, still attached to it some small-pox matter, which small-pox matter was effective, the cow-pox matter failing, then it may be maintained, and indeed, has been maintained, that the local effects on that arm, in spite of its presenting characters which led Woodville to call it a cow-pox tumour, was in reality a small-pox pustule, the matter taken from it was small-pox matter and not cow-pox matter, and the series of cases through which it was propagated were cases of small-pox, and not at all of cow-pox.

When the details of the history of Collingridge's case as recorded by Woodville are examined, it is found that they do not of themselves justify a clear decision as to how the small-pox was introduced; these details are as follows:—

Collingridge was inoculated on the left arm with cow-pox matter. On the fifth day she was inoculated with small-pox matter on the right arm. On the eleventh day (sixth day of variolous inoculation) she "complains of headache and pains about the "loins," signs of 'eruptive fever.' On the thirteenth day (eighth day of the variolous inoculation) "several pustules appear"; on the fifteenth day (tenth day of variolous inoculation) "more pustules are scattered" over the body; on the seventeenth day (twelfth day of variolous inoculation) "the number of pustules is from one to two "hundred." Now, in the ordinary practice of inoculation with small-pox, the 'eruptive fever' began on the seventh, or more usually the eighth day, while the pustules made their appearance at the end of the tenth or beginning of the eleventh day, and usually continued to appear for three days. Hence the 'eruptive fever' (on the sixth day) and the appearance of pustules (on the eighth) are very early if we suppose them due to the variolous inoculation on the right arm. On the other hand, both the 'eruptive fever' (on the eleventh day) and the appearance of the pustules (on the thirteenth) are very late if we consider them as due to small-pox introduced by the supposed cow-pox inoculation on the left arm. But too much stress must not be laid on these dates, since though the times given above are those quoted as the ordinary ones, it was admitted that the eruption, and the fever precursory of it, might appear at an earlier or at a later date. Dimsdale (*Haygarth; Inquiry, page* 23) states, "In the "improved method . . . . . the eruptive fever in every instance within my "experience commenced on some day from the 6th to the 14th, both inclusive." This is consonant with either of the views in question. It sometimes happened (Sutton: "*The Inoculator*," page 118) that a few pustules appeared prematurely, especially near the inoculated spot, before the general eruption. The record on the fifteenth (tenth) day runs: "There are small pustules round the edges of the variolous tumour; more pustules "appear scattered over the face, body, and limbs." If we are allowed to regard the first half of this sentence as a fuller description of the pustules spoken of in the preceding paragraph of the record as appearing on the thirteenth (eighth day), then these pustules would appear to be such premature pustules belonging to the inoculation round which they occurred, and the real eruption of pustules must be considered as those spoken of in the latter half of the paragraph. If this be so, the whole eruption clearly belongs to the inoculation on the right arm and occurs at its proper time.

Suspicion of the left arm inoculation being really one of small-pox and not, as Woodville thought, of cow-pox is raised by the margin of the tumour being described on the 11th day as "beset with minute confluent pustules" (at this epoch the distinction now generally made between pustule (with pus) and vesicle (with lymph) was not as yet made) a character common in small-pox, but at least rare in cow-pox. But against this may be urged that the same tumour is described on the eighth day in the words, "its form is perfectly circular," whereas the margin of a small-pox tumour on the eighth day should be irregular or jagged. Further, even on the 13th day the left arm (cow-pox) tumour is beginning to scab, though it ought to be, as the left arm (small-pox) tumour actually was, still in the vesicular stage, and still surrounded by an efflorescence, an area of redness, if we consider that day as marking the eruption of pustules due to the left arm inoculation; the scabbing is all the more premature if, as suggested, the pustules appearing on the 15th day are to be regarded as the real eruption. Lastly, it was the experience of inoculators of the small-pox, that when a second inoculation was made some days after a first one, the progress of the second was accelerated, so that it overtook the first, and thus the two reached the same phase together; nothing of this is seen in Collingridge's two inoculations, the development of each is independent of that of the other as was recognised to be the case when a cow-pox and a small-pox inoculation were performed at the same time, or nearly the same, time on the same person.

The child Buckland inoculated at the same time as Collingridge and with the same matter clearly suffered from small-pox. Further, the history of the eruption of pustules on the 10th and 11th day, and the appearance on the 7th day of two pustules near the inoculated spot, " premature " pustules, strongly suggest that the small-pox was introduced by the inoculation. Indeed this view presented itself to Woodville himself, but he rejected it on learning that his lancets had been newly ground. It is indeed possible that Buckland took small-pox in the natural way, and the eruption taking place on the 10th day of inoculation was a mere coincidence; but the former view is the more probable; and if Buckland was thus given small-pox by mistake, the same mistake might very well be made in Collingridge's case.

Thus while some of the facts of Collingridge's case point to the first inoculation, others point to the second inoculation as having served for the introduction of small-pox; and, even if the latter be considered as on the whole outweighing the former, they at least do not afford a conclusive proof. The exact nature of the effect on Collingridge's left arm, called by Woodville a cow-pox tumour, must be determined by help of general considerations touching the history of the whole of Woodville's cases.

The view that Collingridge's case was in reality one simply of small-pox has been developed somewhat as follows:—The local effect produced by the virus used to inoculate Collingridge took on, for some reasons or other, characters like, but not absolutely identical with, those of cow-pox; the virus in other words " sported " so as to simulate cow-pox. Matter from this local pustule used to inoculate others, and then others again in succession, the matter being always taken from the local pustule, the inoculation being " arm-to-arm," preserved or rather increased its likeness to cow-pox, the local effect being after a while at least quite indistinguishable from that produced by true cow-pox. It was, found moreover, in many cases still further to simulate cow-pox in that eruptive pustules were absent. And by selecting mild cases, that is, cases in which the eruptive pustules were absent or scarce, this feature of the absence of pustules was fixed, so that eventually absence of pustules was the ordinary result, pustules appearing on rare occasions only. Thus by selection what started as small-pox became indistinguishable from cow-pox. We have further to suppose that the modifications in the nature of the virus put on by the sport was limited to the local tumour. Matter from the local tumour produced a like local tumour, with or without an eruption of pustules; matter from the pustules always or almost always gave rise to eruptive pustules; the local tumour in these latter cases is not accurately described in the record, but in one case, (140th,) is spoken of as " having an angulated border," that is, having small-pox characters.

Support to this view in the way of analogy is furnished by the experience of Adams who, starting with a variety of small-pox known at the time as the " pearly sort," succeeded in obtaining a local effect, which he describes as " having a vaccine appear-" ance," which he was able by arm-to-arm inoculation to propagate, with preservation of its characters, through several generations, and which in some of the cases further simulated cow-pox in the absence of eruptive pustules. He also described a second series with similar results. So far as it goes, Adams' experience is to the point. But Adams' recorded cases are very few; and as Adams himself remarks of the cases, " They are not entitled to the degree of confidence as to the probability of retaining a " permanent character which the cow-pox may claim, nor is there any proof that " these vesicles are not infectious." (*On the Cow-pox, page* 158.) Both series suddenly came to an end.

Against the support afforded by Adams may be placed the fact that the wide experience of the inoculators of small-pox by the improved method during the latter part of the 18th century, affords no support to the view which we are discussing. The object of the improved method was, as has been said, to produce a mild form of small-pox, that is, one with as few pustules as possible, but one, nevertheless, conferring immunity; and had either Sutton or Gatti, or any other inoculator come across a strain of small-pox matter, which, while conferring immunity, could be propagated from arm-to-arm without eruptive pustules, they would, we may be sure, have made much of it. But the literature of the subject records nothing of the kind. Indeed there is no evidence even, that the practice of arm-to-arm inoculation tended to secure paucity or absence of eruptive pustules. The practice has indeed, by some writers, been said to be part of the "improved method"; but neither Sutton nor Gatti in the instructions which they give as to their mode of procedure, put this among them. That it was certainly not an essential part of Sutton's ordinary practice, may be inferred from an incidental remark of his (*The Inoculator*, page 60), that on one day he inoculated 700 persons *from the same subject.* Dimsdale, again (*On Inoculation*, 6th edition, page 26), says, "It seems to be of no consequence whether the infecting matter be taken from "the natural or the inoculated small-pox: I have used both, and have never been "able to discover the least difference, either in point of certainty of infection, the "progress or the event; and, therefore, I take the infection from either as opportunity "offers, or at the option of my patients or their friends." He adds, however, "In all "cases when I take matter from an inoculated person, it is from the place where it "was inserted; as I am always sure to find infection there if the disease succeeds and "always of sufficient energy." Further, as an argument against arm-to-arm inoculation at all ensuring a paucity of pustules, Bromfield recounts (*Thoughts, etc.*; 1767; page 10) how, with matter which had been propagated by arm-to-arm inoculation through 14 generations, 20 children who had all undergone the same kind of preparation were inoculated at the same time; of these "some had the disease very mild and others "rather severe."

Sutton, moreover, so far from expecting mild cases to produce mild cases, appears to have thought the opposite; for his work contains a remarkable passage (pages 58–9), in which, after stating that people in general and even the majority of inoculators limited themselves in the choice of matter for inoculation to the "good natural state of health "of the subject from whom the matter is to be collected; preferring a mild, benign "sort to a copious, malignant, ill-conditioned species," he says, "I have my objections "to inoculate those whom upon examination I rank under the class of unfavourable "subjects, from such as have a very benign small-pox, or from those whose arm indicates "such benignity"; by the former meaning apparently matter taken from a case in which the eruptions had come out, and, therefore, probably from a natural case; by the latter, matter taken from the local pustule at a time when the eruption was not yet out, the character of the local pustule indicating that the eruption would probably be a mild one. He believes such an inoculation would give more of the disease than an inoculation "from a malignant sort, or from those whose arms indicated such malignity." He even says, "I usually employ matter from an untoward stock."

Moreover, the history of the use made of Collingridge's lymph as recorded in Woodville's Reports does not show any selection of non-eruptive cases leading to a gradual elimination of pustules; the appearance of the pustules was irregular and fitful. Woodville, it is true, remarks that while matter taken from a case without pustules may give rise to pustules in others, "yet it has much more commonly had "the effect of exciting a milder disease than the matter of the (eruptive) pustules, or "than that which was obtained from a patient who had the disease in a severe "manner as may be seen by an examination of the table." But though the table shows this clearly as regards the cases in which matter was taken from the pustules, or from cases which had been inoculated from the pustules, it does not show clearly any elimination of pustules in the series originating in Collingridge.

This will be evident from the following table in which the matter from Collingridge is traced out. There is no obvious progressive elimination of pustules. Of the 122 cases, 54 (about 44 per cent.) are non-pustular; while the last four groups give 23 cases with 15 non-pustular (*i.e.*, about 65 per cent.), the four groups just earlier give 29 cases with 11 non-pustular (*i.e.*, about 38 per cent.), and the three groups just earlier give 30 cases with 14 non-pustular (*i.e.*, about 47 per cent.). One of the best groups (that is, most free from pustules) is that from Bumpus, the second remove; one of the worst is that from Spooner, the last remove but one recorded, though Spooner was a milder case (with fewer pustules) than Bumpus; and S. Timms, with no pustules, gives worse results than Platford, with a thousand—both equally removed from Collingridge. Matter from Bumpus, used outside the Hospital (namely, by Jenner and Marshall) gave only one or two pustular cases in more than 300 cases; but on this we shall dwell later on. It is singular that Woodville allowed Bumpus strain to drop, and it is worth while noting how many of the cases are derived from Jewel, who had no eruptive pustules; and whose case is insisted on by Woodville himself as a proof that the matter he was using was cow-pox since Jewel had previously had small-pox, and had the matter with which she was inoculated been small-pox it ought not have taken.

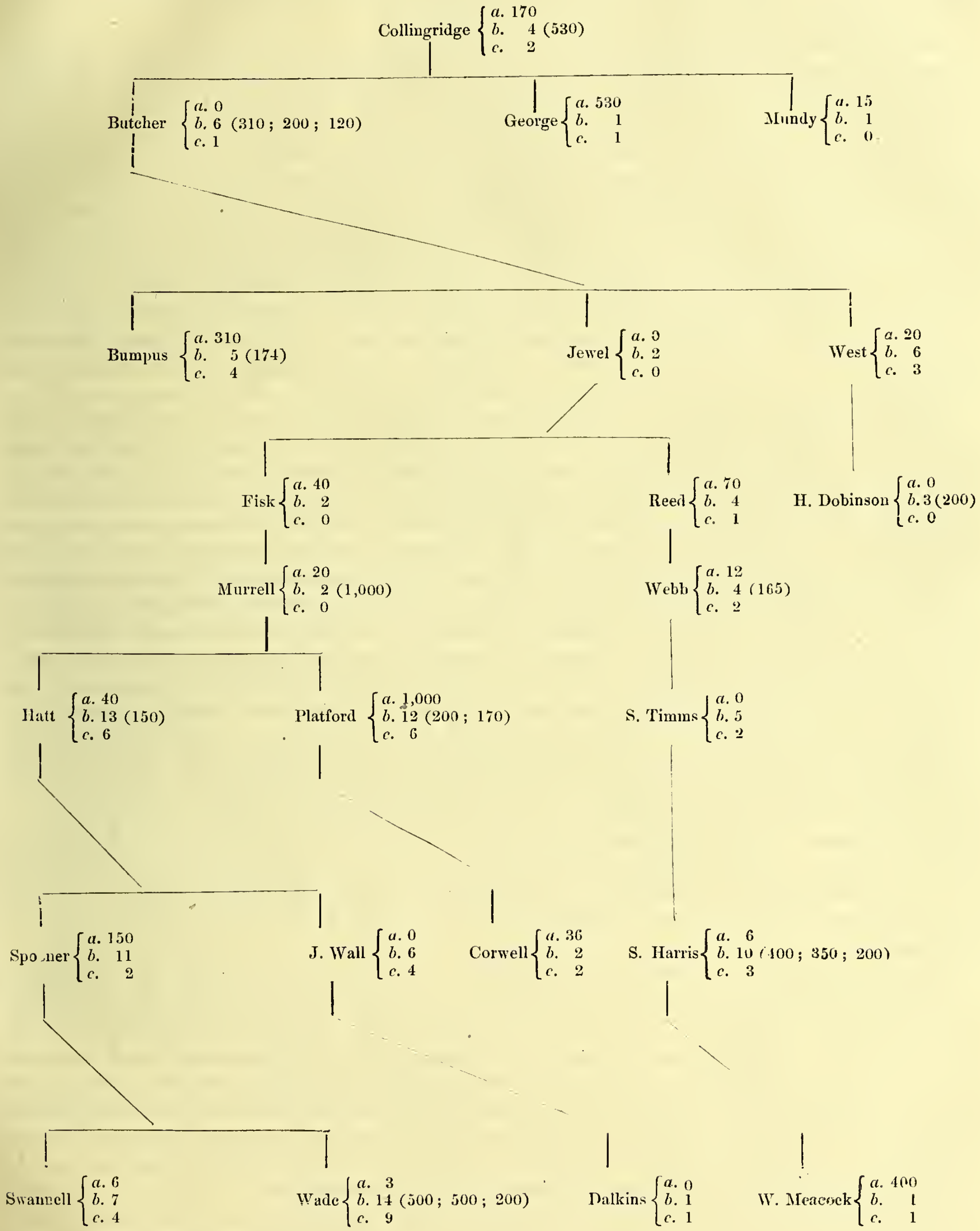
App. 1.

The figures against the names in the table below indicate :—

a.—The number of pustules appearing in the case itself.

b.—The number of cases done from the tumour on the arm of the case. (The figures in brackets giving the number of pustules, in the cases so done, in the instances where they exceeded one hundred.)

c.—The number of the above cases in which pustules were absent.


Collingridge a. 170 b. 4 (530) c. 2
Butcher a. 0 b. 6 (310; 200; 120) c. 1
George a. 530 b. 1 c. 1
Mundy a. 15 b. 1 c. 0
Bumpus a. 310 b. 5 (174) c. 4
Jewel a. 0 b. 2 c. 0
West a. 20 b. 6 c. 3
Fisk a. 40 b. 2 c. 0
Reed a. 70 b. 4 c. 1
H. Dobinson a. 0 b. 3 (200) c. 0
Murrell a. 20 b. 2 (1,000) c. 0
Webb a. 12 b. 4 (165) c. 2
Hatt a. 40 b. 13 (150) c. 6
Platford a. 1,000 b. 12 (200; 170) c. 6
S. Timms a. 0 b. 5 c. 2
Spooner a. 150 b. 11 c. 2
J. Wall a. 0 b. 6 c. 4
Corwell a. 36 b. 2 c. 2
S. Harris a. 6 b. 10 (400; 350; 200) c. 3
Swannell a. 6 b. 7 c. 4
Wade a. 3 b. 14 (500; 500; 200) c. 9
Dalkins a. 0 b. 1 c. 1
W. Meacock a. 400 b. 1 c. 1

Further, while Collingridge's local tumour was the source of much of the lymph used or distributed by Woodville, it was not the only source. From the sores of the dairymaid at the Gray's Inn Lane "dairy" five cases were inoculated. One of these (Crouch) had no eruptive pustules, and matter taken from his arm produced cow-pox in a cow belonging to Mr. Coleman; we may conclude that Crouch's case was one of veritable cow-pox. But Harris and Bunker, done on the same day, and with the same matter had eruptive pustules, the former 300, the latter only 3. These two cases, being inoculated for small-pox on the fifth day of the inoculation with cow-pox matter, are parallel to that of Collingridge. If their pustules were due to the second inoculation, they supply an argument of analogy in favour of Collingridge's pustules having a like origin. If we suppose, as the view concerning Collingridge which we are discussing supposes, these two cases were simply cases of small-pox, due to an unclean lancet being used, we are not only met with the difficulty of such an accident being repeated again twice so soon, but the far greater difficulty that the small-pox matter used, (and if separate lancets were used for each, the small-pox matter in each case might have had different origin,) "sported" again as it did in the case of Collingridge, and gave birth to a cow-pox like local tumour.

Further, from Coleman's cow, which we may assume to be veritable cow-pox, three cases were inoculated. Each of these had an abundant crop of pustules. If these pustules were due to an unclean lancet, as has been supposed in the case of Collingridge, we must repeat afresh the hypothesis of the small-pox matter "sporting"; and this on the doctrine of chances presents enormous difficulties. If the pustules had some other origin, (which in these three cases must have been natural contagion, since they were, not as was Collingridge, inoculated with small-pox early in the disease,) we must conclude that the local effect was a veritable cow-pox tumour. But these three cases especially one (Streeton) were the origin of much of the lymph used (and presumably distributed) by Woodville. The series of cases proceeding from Streeton's local tumour run closely parallel to the series proceeding from Collingridge, pustules appearing and disappearing in a like fitful irregular way. If Streeton's series was one of cow-pox, it is very difficult indeed to suppose that Collingridge's series was one of small-pox.

Lastly it became early acknowledged in the practice of cow-pox inoculation that while cases with eruptive pustules were contagious, that is to say, produced a like disease by contact or proximity. cases without such pustules were not. (Woodville Observ., p. 31. Fosbrooke; *Med. Phys., vol. III.*, p. 247.) Now it is true that some authors maintained that cases of inoculated small-pox showing the local pustule only were not contagious; but these authors had an ulterior reason for their contention, namely, their desire to prove that the practice of inoculation did not increase the prevalence of small-pox; and this lessens the value of their opinion. Even admitting that the contagion, itself, the *materies morbi*, is produced or contained in the pustules, and distributed from them, and that, therefore, a case with many pustules is more contagious, emits more "particles of contagion" than a case with few, and *à fortiori*, than one with the local tumour only, the evidence goes to show that no true case of inoculated small-pox should be considered free from contagion; this was the opinion of the inoculators and Dimsdale (*Op. cit.* p. 93, *see also* p. 39) quotes a case in point. The "sport" which the small-pox put on in the case of Collingridge must, therefore, according to the view which we are considering, have further simulated cow-pox in the loss of contagiousness. It is, of course, not possible outside Woodville's report to disentangle the cases derived from Collingridge from the cases having other sources; but unless all the other sources are like that of Collingridge, to be regarded as sports of small-pox, this very fact increases the difficulty of regarding Collingridge's case as being of that nature.

The supposition, then, that the local effect on Collingridge, called by Woodville a cow-pox tumour, was in reality a small-pox tumour of a special kind, lands us in an accumulation of difficulties. On the other hand, all difficulties, except the minor ones which we have discussed as presented by the details of Collingridge's case, vanish if we suppose that Woodville was right in calling the local effect a cow-pox tumour, and that the lymph taken from the local tumour used and distributed by him was vaccine lymph, and that where pustules did appear they were (putting aside the possibility of generalized vaccinia) pustules of accompanying small-pox introduced in some cases by premature inoculation, but in most cases by natural contagion.

This latter view explains why Woodville found no difference in his results at the Hospital between lymph of different sources, not only between that of Collingridge and the others on which we have dwelt, but also between these and the virus "produced in "different cows" procured by him "at various times"; he says (*Observations*, page 19) "the effects of all the matter I tried were perfectly similar, and pustules proved to be "not less frequently the consequence of these trials than of those made with the "matter formerly employed." This view also explains the contrast with which Woodville himself was struck, between the cases at the Hospital and cases away from the Hospital. At the beginning Woodville on several occasions used matter from the eruptive pustules, that is, small-pox matter, and it is very probable, as has been said, that some of the matter distributed from the Hospital, for instance, by

Pearson was taken from the eruptive pustules, and that in some of the cases outside the Hospital, in which an eruption of pustules was recorded, this matter was used. But the cases outside the hospital in which eruptive pustules appeared were exceptional. Woodville himself states that not only in the cases inoculated with the matter from Bumpus sent to Jenner, but in nearly all other instances the matter which in the Hospital continued to produce pustules, when sent abroad did not produce them. He mentions (*Observations*, 1800; page 21) as exceptions matter sent to a village where small-pox was raging and where one in five had pustules, and matter sent to Mr. Evans of Ketley, who, like Woodville, was carrying on cow-pox and small-pox inoculations at the same time in the same house, more than half of whose patients had pustules; he argues that the pustules were due, not to the nature of the lymph sent, but to the presence of small-pox in the localities.

Jenner, with what some might call rashness but others sagacity, maintained from the very first that the eruptive pustules were indications of small-pox. Woodville, as we have seen, at first believed that the eruptive pustules were a natural part of the malady, and spoke of the cases as being mild or severe according to the number of such pustules occurring. He held this view when he published his Reports in May 1799, and indeed three-fifths of the cases there recorded exhibited pustules, (in many of them, however, the matter used for inoculation was itself derived from the eruptive pustules). Writing in June 1799, that is a month later (*Med. Phys. Jl.* Vol. I., p. 417), he reports that out of 310 cases, subsequent to the Reports only 39 had pustules, the last 110 of these having pustules in 7 cases only. He says this confirms the opinion expressed in the Reports that matter taken from mild cases tended to produce mild cases, or that the disease actually became milder in its progress from patient to patient, that is to say, the very nature of the virus was affected by the mere transmission through a series of human beings. But he ends with a striking sentence that these cases lead " to a conclusion widely different from that published in the Reports." In his *Observations*, the Preface of which is dated July 1, 1800, in quoting 2,000 cases he states that "in the Hospital, however, the disease still continues to occasionally " produce pustules, though not more than in the proportion of three or four cases " out of a hundred." Six months later, December 1800 (*Med. Phys. Jl.*, Vol. V., p. 6), he speaks of the cases which had at the date of his last publication " received " the vaccine infection " as exceeding 2,500, and says that since that time upwards of 1,500 have been inoculated for the cow-pox at the same place, and that " the number " of pustular cases . . . . . has been even less than three or four out of a " hundred." He now states that he is convinced that an eruption of variolous-like pustules " will be found to be a very rare occurrence unless previously to the vaccine " inoculation, or during its local progress the patient has been exposed to the action " of variolous matter." This probably " is the conclusion widely different from that " published in the Reports," foreshadowed in his writing of June 1799; that is to say, he now abandons the view then expressed that the diminution of pustular cases is due to the selection of mild cases or to weakening by continued transmission.

Thus, though, as has been said, the occurrence of pustules was irregular in the cases recorded in the Reports, the absence of pustules occurring quite early in the series and being fitfully continued, so that they cannot be said to show a distinct progressive elimination of pustules there was in the subsequent cases, especially in the later of these, a distinct progress towards an absence of pustules. This might have been in part due to Woodville's abstaining from using the matter of the eruptive pustules, as well as from premature inoculation with small-pox, but could only in part have been so due. On the other hand, in the Hospital it was natural that pustules should be common so long as Woodville thought, as he did at first, that they formed a natural part of the disease, and that they should become less so soon as he became aware, as apparently he did so early as June 1799, that they were due to the patient being exposed to the action of variolous matter; so soon as he had grasped this view he would take care that those inoculated with cow-pox should be exposed as little as possible to the action of variolous matter, no care at all having been taken previously. The marked diminution of pustular cases coincides with Woodville's change of views.

Reviewing then all the evidence, no conclusion seems justifiable other than the one that all Woodville's and Pearson's cases (excluding of course all those in which the matter used was taken from the eruptive pustules and not from the local cow-pox) were cases of cow-pox, however much some of them might have been mixed up with small-pox.

App. 2.

APPENDIX II.

Tables, furnished by the Registrar-General, showing for England and Wales :—

(*A.*) *The deaths from small-pox at certain age-periods, to one thousand deaths from small-pox at all ages, in each year* 1848–1894; *and*

(*B.*) *The death-rates from small-pox, per million living at certain age-periods, in each year* 1848–1894.

[*N.B.—In both tables deaths returned as from chicken-pox are unavoidably included as regards the years* 1848–1854 *inclusive.*]

(*A.*)—*Deaths from small-pox at certain age-periods, to one thousand deaths from small-pox at all ages, in each year* 1848–1894.

Year.	Under 1 Year.	1–	5–	10–	15–	25–	45 and upwards.
1848	235	457	130	37	72	58	11
1849	250	427	145	35	65	60	18
1850	268	432	133	35	65	55	12
1851	258	439	131	33	68	59	12
1852	267	426	122	32	75	62	16
1853	273	413	123	31	71	70	19
1854	203	388	128	31	108	107	35
1855	194	321	135	31	135	143	41
1856	231	329	122	40	134	108	36
1857	243	345	164	31	94	98	25
1858	234	319	173	39	105	106	24
1859	252	327	126	44	116	104	31
1860	232	324	112	42	121	132	37
1861	242	295	108	47	125	126	57
1862	231	328	110	45	122	125	39
1863	236	308	105	37	129	140	45
1864	243	312	105	37	119	140	44
1865	233	272	102	41	134	163	55
1866	222	320	99	32	136	146	45
1867	239	298	86	31	133	160	53
1868	239	351	102	31	115	123	39
1869	221	327	126	30	111	136	49
1870	179	284	143	38	140	170	46
1871	135	199	149	56	181	221	59
1872	137	162	164	66	191	214	66
1873	132	99	138	62	224	258	87
1874	129	100	107	70	263	258	73
1875	106	101	108	80	261	254	90
1876	119	135	108	67	214	286	71
1877	102	145	112	72	216	270	83
1878	119	135	117	77	213	255	84
1879	116	127	119	63	187	265	123
1880	120	142	117	76	196	267	82
1881	103	136	109	68	205	276	103
1882	98	111	77	61	226	325	102
1883	131	104	95	62	239	262	107
1884	114	116	92	71	214	302	91
1885	120	126	79	63	185	312	115
1886	113	80	65	40	189	313	200
1887	121	73	61	61	283	328	73
1888	119	81	63	49	230	329	129
1889	86	43	—	43	261	437	130
1890	188	63	—	—	188	373	188
1891	246	102	61	61	82	285	163
1892	117	148	77	9	132	359	158
1893	141	142	66	30	110	305	206
1894	140	133	45	28	143	367	144

Chicken-pox unavoidably included in the years 1848–1854 inclusive.

(B.)—*Death-rates from small-pox, per million living at certain age-periods, in each year* 1848–1894.

Year.	All ages.	Under 5 years.	5–10 years.	Total under 10 years.	10–15 years.	15–25 years.	25–45 years.	45 years and upwards.
1848	397	2,090	439	1,311	135	149	86	23
1849	264	1,364	326	874	86	90	59	26
1850	262	1,400	298	881	86	89	54	18
1851	389	2,066	438	1,299	121	139	86	25
1852	401	2,117	420	1,319	119	158	93	34
1853	171	892	180	558	50	64	45	17
1854	151	675	165	436	44	86	61	28
1855	131	512	151	343	39	93	70	28
1856	116	491	122	318	44	82	47	22
1857	202	891	283	607	59	100	75	27
1858	330	1,364	489	956	121	185	132	42
1859	193	835	208	543	82	119	76	31
1860	136	564	130	362	54	87	67	27
1861	64	256	59	165	28	43	30	19
1862	78	322	73	206	33	50	37	16
1863	286	1,153	255	735	101	198	151	67
1864	364	1,500	325	953	126	232	193	83
1865	301	1,127	260	723	117	217	187	86
1866	139	558	117	352	41	102	78	33
1867	114	453	82	280	33	82	69	31
1868	91	396	78	247	27	56	43	18
1869	67	271	71	177	19	40	35	17
1870	113	388	136	270	40	86	74	27
1871	1,012	2,502	1,265	1,922	529	994	860	306
1872	821	1,815	1,130	1,494	503	851	676	279
1873	98	167	114	142	57	119	98	44
1874	88	148	79	116	57	125	87	34
1875	35	54	32	44	26	49	35	16
1876	99	185	89	140	62	113	108	37
1877	173	316	161	243	116	201	180	76
1878	74	139	72	108	53	85	73	33
1879	21	38	21	30	12	21	22	14
1880	25	49	24	37	18	26	26	11
1881	119	210	107	161	75	130	127	65
1882	50	78	32	56	28	60	63	27
1883	36	64	28	47	20	46	36	20
1884	83	145	63	106	54	93	96	40
1885	104	197	69	136	60	101	123	63
1886	10	15	5	10	4	10	12	11
1887	18	28	9	19	10	27	23	7
1888	36	58	19	39	16	44	45	25
1889	0·8	0·8	—	0·4	0·3	1·1	1·3	0·6
1890	0·6	1·1	—	0·6	—	0·5	0·8	0·5
1891	1·7	4·8	0·9	2·7	0·9	0·7	1·8	1·4
1892	15	32	10	21	1	10	20	12
1893	46	105	26	67	12	26	52	49
1894	27	61	11	36	7	20	38	21

Chicken-pox unavoidably included in the years 1848–1854 inclusive,

Statement by Dr. Collins and Mr. Picton of the Grounds of their Dissent from the Commission's Report.

1. We entirely agree with the Report of our colleagues in so far as it shows the great change of professional and scientific opinion since vaccination first engaged the attention of the Legislature, and since the passing of the first compulsory Act in 1853. We hold with them that the prophylactic power of vaccination has been at least exaggerated, and that dangers incidental to the practice, though at one time denied, "are "undoubtedly real and not inconsiderable in gross amount." We gladly added our signatures to theirs in support of the Commission's interim report recommending the abolition of repeated prosecutions, and also that recalcitrants against the vaccination laws should no longer be subjected to the same treatment as criminals. We now desire also, if compulsion in any form is to be maintained, to support their final recommendations for the relief of conscientious nonconformity with the law. We also gladly endorse the precautions they recommend with the object of preventing avoidable dangers in connexion with the operation. There is no difference among us on these points ; so far as these recommendations go the Commission is absolutely unanimous. We feel, however, that the evidence not only justifies but requires a more complete reconsideration of the present state of the law as well as of the methods adopted in dealing with small-pox. For this purpose it is necessary to review in some detail the history of small-pox and the various preventive measures which have at different times been in vogue, and to scrutinise the grounds on which one alone of these preventive measures has been relied upon to the exclusion of others. We desire also to give reasons for thinking that other more effective and practicable (as well as less objectionable) modes of stamping out small-pox, or protecting communities from its introduction, are available. We venture to think that the report of our colleagues, in the preparation of many portions of which we have borne our part, has approached the consideration of the behaviour of small-pox, and the means of preventing it, too exclusively from the standpoint of vaccination, and that too little attention has consequently been accorded to sanitary organisation, prompt notification and isolation, measures of disinfection and cleanliness, and healthy conditions of living, which we believe to be of the first importance in preventing and controlling outbreaks of small-pox.

Reference I.—The effect of vaccination in reducing the prevalence of, and mortality from, small-pox.

2. The origin and antiquity of small-pox are involved in obscurity. No account of the disease appears in the writings of Hippocrates or Galen ; it seems to have been unknown in ancient Greece and Rome. Unambiguous evidence of its presence on the Continent of Europe is to be found in the 15th century, and scattered references of more debatable character may be found in the two previous centuries.

Small-pox, like the plague and some other infectious maladies, appears to have, as it were, its habitat in certain countries, and its diffusion thence results from importations under favourable circumstances of the morbid poison by infected persons or things. Such native foci of small-pox are said to be the countries of Central Africa and India.

3. The first extant work on small-pox is by an Arabian physician, Rhazes of Bagdad, written in the 10th century A.D. His account of the disease was so accurate and complete that it served as a model for many medical writers when the disease became common in Europe.

4. Various theories of the cause of small-pox were advanced in mediæval writings, but contagion, though referred to by some of the earlier Arabian authors, was not thought to be of importance. No doubt small-pox was often confounded with other eruptive diseases, such as measles, and even as late as 1700 these were classed together in Bills of Mortality. Sydenham (1624–89) described fully the small-pox as it occurred in London in the 17th century. He emphasised the distinction between small-pox and measles, and introduced the "cool treatment" for these diseases. He describes small-pox as prevailing epidemically, attacking persons of all ages, varying greatly in its severity ; the mortality being in his opinion largely augmented by mischievous treatment. Sydenham, like his contemporaries, did not attribute the propagation of small-pox to

contagion, but to what he termed the "epidemic constitution of the atmosphere" due to "certain hidden and inexplicable changes within the bowels of the earth."

5. It was reserved for Boerhaave, of Leyden (1668–1738), to proclaim the view, now generally accepted, that small-pox arises only from contagion.

6. During the 17th century small-pox became more prevalent in Western Europe, especially in large towns and trading ports. It was introduced into Boston (U.S.A.) early in the century; and on numerous occasions epidemics in the West Indies and South America have been traced to slave importations from Africa. On the other hand it appears that places and countries naturally isolated, or removed from the more populous centres of human intercourse, then, as now, enjoyed complete or comparative immunity from the disease. Thus the Faröe Islands were first infected by a ship from Denmark in 1651, Cape Colony in 1713 by a ship from India, while the continent of Australia, it is stated, enjoyed an absolute immunity until 1838, and the island of Tasmania continued to be exempt until 1887.

7. In view of the curious notions entertained by the most learned medical writers in the 17th century as to the propagation of small-pox, and the superstition with which an epidemic was regarded by the common folk, it is not surprising that the century closed without any effort being made to protect individuals or communities from this disease. In London the ravages of the Plague until its extinction in 1680 appear to have eclipsed the lesser evils of the small-pox, and to have absorbed whatever of organised effort was available on the part of those responsible for the public health.

8. The London Bills of Mortality were first compiled by the parish clerks in 1629, and though the data they furnish in regard to the deaths from various diseases cannot be regarded as even approaching to scientific accuracy, they give some idea of the health, or rather of the unhealthiness, of 17th century London.

Annual Death Rates in London per 100,000 living.

Vol. 1, App., p. 88.

Causes of Death.	1629–35.	1660–79.
All causes	5,000	8,000
Plague	125	1,225
Fever	636	785
Small-pox	180	417

There can be no doubt that the conditions which obtained in London "within the "Bills" during the 17th century were in the highest degree favourable to the propagation of pestilential diseases. The general death-rate was enormously high, and though plague disappeared soon after the Great Fire, fevers and small-pox became more severe and fatal and were perennially endemic.

9. Not only were the insanitary conditions which prevailed well calculated to foster and perpetuate any infection which happened to be introduced, but owing to the non-recognition of the part played by contagion in the dissemination of these diseases, the latter were accepted as well nigh inevitable evils, and no effort was made to restrict 11,004. their ravages.

10. In 1710, for the first time since the Bills of Mortality had been compiled, more than 3,000 deaths were ascribed to small-pox in London, or 127 per 1,000 deaths from all causes. The prevalence of the disease led to many speculations as to possible means of deliverance from it. The orthodox teaching of propagation by "epidemic constitution of the atmosphere" was not calculated to inspire sanitary precautions, or the separation of the sick from the whole. Mead's work on the prevention of contagions, primarily directed against a threatened invasion of plague, was Vol. IV., not written until 1720. On the other hand there were reports from the Levant, where App. 1, small-pox had been long endemic, that by a method of "engrafting" the disease p. 400. artificially it might be robbed of its terrors. As far as the epidemiological history of 10,332– small-pox can be followed back in Asia and Africa, we find records of the popular 10,335. practice in some form or other, and often with religious associations, of the artificial 107– induction of the disease. Even in Wales and Scotland, and in Western Europe, 10,340. some kind of popular tradition of a similar practice has been traced by some authorities.

11. Whatever credit may attach to the introduction of the practice of inoculation into this country is, however, due to Lady Mary Wortley Montagu. During her residence at Pera, while her husband was Ambassador to the Porte, Lady Mary learnt that it was there the fashion "to take small-pox by way of diversion as they take the waters

"in other countries." In a letter, dated 1717, she announced her intention of submitting her son, aged five, to the operation, and added, "I am patriot enough to "take pains to bring this useful invention into fashion in England." Her son was accordingly inoculated by a Greek woman, under the supervision of Mr. Charles Maitland, Surgeon to the Embassy, and he passed favourably through the disease. Lady Mary returned to London, and in the spring of 1721 had her younger child inoculated by Maitland. The operation, which was satisfactory, was witnessed by three physicians, as well as several ladies and persons of distinction. In August 1721 inoculation was tried experimentally on six criminals at Newgate, and the practice was encouraged by the Court.

12. While the effects in most of the early cases appear to have been mild, a few terminated fatally, and the practice became for a while less popular. After 1740, however, inoculation was revived, and, in the modified form of Dimsdale and Sutton, was widely adopted in many parts of the United Kingdom. In 1746 an inoculation hospital was started in London, and in most of the large provincial towns the new practice was encouraged by the clergy, as well as the leading medical practitioners, Vol. 1, p. 66. "and in 1754 the Royal College of Physicians of London pronounced its authoritative sanction of what was no longer a speculative novelty." The resolution of the College was:—"The College, having been informed that false reports "concerning the success of inoculation in England have been published in foreign "countries, think proper to declare their sentiments in the following manner, viz.:— "That the arguments which at the commencement of this practice were urged against "it have been refuted by experience; that it is now held by the English in greater "esteem, and practised among them more extensively than ever it was before; and "that the College thinks it to be highly salutary to the human race." From this date to the end of the century inoculation was widely diffused, though to varying degrees, in different districts; the practice doubtless paved the way for the later acceptance of vaccination. The latter came to replace the former method, and by the Act of 1840, sec. 8, the practice of inoculation became a penal offence.

13. Now the practice of inoculation was based on the belief that one attack of small-pox protected from subsequent attack those who recovered. And it was argued that the artificially-inoculated disease, though usually far less severe than the natural disease, yet afforded a similar immunity. It is neither necessary nor profitable to discuss at any length the various theories that have been advanced to account for such immunity; suffice it to say there exists, and has always existed, a belief, shared by medical writers, that in the case of many infectious diseases one survived attack affords a certain amount of protection against a second attack. We are not aware of any large body of statistical evidence which can be cited in support of the general statement; but the belief is held by those most conversant with the facts, and has been insisted on most strongly in the case of small-pox. It has been stated that second attacks of such 4545. diseases, when they do occur, are more severe than the first, and there is, so far as we 26,127. know, no ground for asserting that second attacks of infectious diseases are in any way mitigated in severity by the abiding influence of the first attack.

24,848. 14. The earlier writers on small-pox appear to have held that second attacks of the disease undoubtedly occurred and not unfrequently. The view that second attacks of small-pox occurred was held by Sydenham, also by Diemerbroek who observed that the eruption was more severe in second attacks than the first. The case of Louis XV. has been often quoted; he had a first attack at 14, and died of a second attack at 64. During the inoculation period the possibility of second small-pox was emphatically denied by several writers. After the introduction of vaccination the controversy which took place over its relative merits when compared with those of inoculation brought to light numerous instances of second small-pox in the same individual. Jenner collected more than a thousand cases of the kind. Moore says, "For some years the periodical and 24,850. "other medical publications teemed with cases of small-pox occurring twice." At the present time cases of second attacks of the disease are usually met with in every outbreak 26,125. of any extent, and it would seem reasonable to conclude that the protection afforded by a previous attack, though considerable, is by no means absolute. Moreover, 4545. 24,937. experience, though of limited amount, appears to show that no mitigating influence is exerted by the first upon a second attack should it occur.

15. Notwithstanding the extensive practice of inoculation, or, as has been alleged, in consequence of it, small-pox continued throughout the 18th century to be endemic in London, and severely epidemic, often at frequent interval in many towns and villages in this country and abroad. During the latter half of the century attention was called by many writers to the serious evil to society of partial and

indiscriminate inoculation. It was shown that, whatever advantages might result to the inoculated by way of protection from attack, the practice had frequently been the means of introducing the disease into towns and villages that were previously free from it, and that it could only be worked at an intolerable cost of life. Vol. 1, App., p. 66.

16. Attention was also, about this time, called to the restrictive influence which might be exerted upon outbreaks of small-pox by separating the sick from the healthy. The part played by contagion in the propagation of epidemics had, since the adoption of inoculation, come to be clearly recognised, and measures were suggested for stamping out small-pox on the lines of methods employed against the plague. Rast. Faust. 11,015. Haygarth. Dimsdale, 1105.

Some, like Haygarth, suggested the combination of general and systematic inoculation at stated intervals with measures of isolation. Others, like Rast, Faust, and Cappel, advocated hospital isolation of the infected, and regarded inoculation as not only superfluous, but dangerous, and opposed in principle to the proper method of exterminating the infectious poison. 10,796–10,969.

17. It was at this juncture that the value of the cow-pox as a protection against small-pox attracted attention. It could be inoculated, like the small-pox, from one person to another, but unlike the latter it was stated to be not communicable by infection. If it afforded protection against small-pox without spreading the disease, opinion was evidently ripe for the substitution of the one practice for the other, for inoculation had come to be regarded about this time, not merely as a troublesome affair to those who submitted to it, but as a serious evil to society. Henceforth the controversy over the cow-pox absorbed almost exclusively the attention of those concerned for the prevention of small-pox, and for a long while little was heard of any means other than vaccination, such as isolation, &c., for the suppression or restriction of the disease. 10,803. Vol. 1, App. p. 66.

18. From such records and statistics as are available it would appear that small-pox was more prevalent and the mortality from it was greater, especially in large towns, during the 18th century than it had been in the 17th. It is also true that, speaking broadly, the present century compares favourably with the last; the disease has not been the scourge that it then was. Prior to 1838, when official registration of the causes of death in this country began, the longest series of figures, and those which have been most often quoted, are the London Bills of Mortality. The following figures are taken from a table put in by Sir J. Simon, which was compiled by Dr. Farr, with due regard to the many sources of error which these Bills admittedly contain:—

ANNUAL DEATH RATES in LONDON per 100,000 living at SEVEN DIFFERENT PERIODS during the YEARS 1629–1835, from—

——	All Causes.	Small-pox.	Fever.
1629–35	5,000	180	636
1660–79	8,000	417	785
1728–57	5,200	426	785
1771–80	5,000	502	621
1801–10	2,920	204	264
1831–35	3,200	83	111

There was evidently a great improvement in the health of London, as measured by the fall of the death-rate from all causes, from its highest point in the Plague period, to a rate of about one half or one third of what it had been. A great improvement took place between the middle of last century and the earlier years of the present. Dr. Farr, remarking on these figures, says:—

"The diseases of London in the 16th century still prevail in unhealthy climates; "not only the diseases and the manner of death have changed in this metropolis, but "the frequency and fatality of the principal diseases have diminished."

"Small-pox attained its maximum mortality after inoculation was introduced. The "annual deaths of small-pox registered 1760–79 were 2,323; in the next 20 years, "1780–99, they declined to 1,740; this disease, therefore, began to grow less fatal "before vaccination was discovered; indicating, together with the diminution of "fever, the general improvement of health then taking place. In 1771–80 not less "than 5 in 1,000 died annually of small-pox; in 1801–10 the mortality sank to 2, "and in 1831–5 to 0·83."

“ Fever, exclusively of the plague, has progressively subsided since 1771 : *fever has* “ *declined nearly in the same ratio as small-pox.* In the three latter periods of the “ table the deaths from fever decreased as 621 : 264 : 111 ; from small-pox as 502 : “ 204 : 83.”

19. We think these figures suggest that the fall of the death rates from fever and small-pox were associated in cause as well as in time with the improvement in the public health which the fall in general mortality indicates. It is possible that inoculation as practised in London in the latter part of last century, prevented an earlier or greater
5491–3. reduction in small-pox than actually took place. Among the influences at work in the last quarter of the 18th century which would tend to counteract any injurious influence of inoculation were the progressive rooting out of small-pox from our prisons, the sanitary improvements in our towns, the growth of what has been termed the “ new “ humanity,” which made the care of the sick and the protection of the public health against noxious agencies matters of public concern and active philanthropy, influences for good with which the names of Howard and of Cook and of Haygarth are honourably and eternally associated.

Since Dr. Farr compiled the figures which we have quoted above, we have five completed decades of registration statistics, and extracting for London the death rates to the same scale from all causes, from small-pox, and from fever we obtain the following :—

Annual Death Rates in London per 100,000 living from :—

—	All Causes.	Small-pox.	Fever.
1841–50	2,500	40	97
1851–60	2,400	28	88
1861–70	2,400	27	90
1871–80	2,240	45	37
1881–90	2,037	14	21

20. Objection has been taken to a comparison between fever and small-pox when endeavouring to decide what has been the influence of the various agencies collectively spoken of as “ sanitation ” upon either, on the ground that the term fever has varied in its signification, and that measles and whooping-cough should be therefore used instead for such comparison. We cannot agree with this view ; our knowledge of the history,
871. epidemiology, and behaviour of measles and whooping-cough does not suggest to us that they have hitherto been very amenable to sanitary reforms, or that they present an analogy with small-pox, like the fevers and especially typhus fever. As regards the objection that the nomenclature has varied, it appears that Dr. Greenhow and Dr. Farr, in the figures which Sir J. Simon quotes from them, paid particular attention to this
Simon, '57. Papers, App. p. 29, and Vol. i, App., p. 88. source of fallacy, thus the former writer, “ throwing into one group all those deaths of “ the present day which might have been included under the old application of the word “ ‘ fever ’ (counting scarlet fever, and inflammation of the brain, and inflammation of “ the lungs in this category), still finds that even with this large addition the so-called “ ‘ fever ’ of the present day occasions only a death rate of 385 per 100,000, whereas a “ century ago its death-rate was close on 539.”

21. But since 1869 the Registrar-General has separately distinguished deaths from typhus, typhoid, and simple fever, and we find that the decline has not been at the expense of one of these classes only, but has been shared by all.

The 42nd report of the Registrar-General, p. xxx, says : “ Had the deaths from one “ or more of this group (fever) of causes fallen, while those from others in the same “ group had risen ; or had the fall been trifling ; or the totals dealt with insignificant “ in amount ; it might have been suspected that the alteration was a mere alteration “ of name. But as the deaths under each heading have declined ; as the fall in the “ death rate from them has been enormous, 62·4 per cent. in the course of 10 years ; and “ as the totals are by no means small ; it may be accepted as an indisputable fact that “ there has in truth been a notable decline in these pests, and it may be fairly assumed “ that the decline is due to improved sanitary organisation. The deaths from these “ causes, per million persons living, were 850 in 1869, and only 320 in 1879.”

ANNUAL DEATH RATES per MILLION living (ENGLAND).

——	Typhus.	Typhoid.	Simple Fever.
1871–5	81·4	373·8	140·2
1876–80	34·2	277·2	69·2
1881–85	22·8	216·0	34·2
1886–90	6·6	179·2	16·6

We are, therefore, led to the conclusion that the great fall in the fever death rate 352, 354,
since the middle of last century in London is a real and substantial one, that it is in 382.
all probability due to greater sanitary activity, and that a fall of about the same amount has during the same period taken place in small-pox mortality, and we are unable to agree that it is not largely due to similar causes.

22. The infectious nature of the inoculated small-pox came as a surprise to the first 10,551.
inoculators in England; but it was not long before the practice was accused of introducing and spreading the disease. Thus Dr. Wagstaffe, writing in 1722, instanced an occurrence in the town of Hertford, where, in consequence of a few inoculations, the small-pox had spread and occasioned a considerable mortality. (Moore's "History of Small-pox," p. 242.) Moore, alluding to these occurrences, remarks (p. 233) that they should have "induced the profession to pause ere they proceeded, or at least to have "prompted them never to inoculate without adequate measures being adopted to "prevent the infection spreading to others. The neglect of this easy precaution has "occasioned the loss of millions of lives." Statistics prepared by Dr. Jurin and others, appeared to prove the advantages of inoculation to those who received it, but Moore, alluding to Jurin's calculations, said (p. 243, "History of Small-"pox"):—"These proved that an individual who resided in London, or in any large city "where the small-pox prevailed, had a much better chance of surviving that disease by "being inoculated; but they did not apply to the country, or to places where the "small-pox was infrequent. And, as in the year 1723, a great increase of the "mortality by small-pox took place in London; Dr. Jurin expressed his opinion that "this ought not to be imputed to inoculation, as the numbers who had been inoculated "in town that year did not exceed 60. This was a very inadequate answer; a single "person may bring the Plague into a town, or into a nation, and be the cause of the "destruction of an innumerable multitude. The small-pox is fully as infectious a "disease as the Plague, and sixty inoculations were more than sufficient to account "for the augmented mortality, and were probably the real cause of it." Without accepting this opinion we are nevertheless satisfied that inoculation did tend to establish and spread the disease, and introduce it into places which would probably have otherwise remained free, and that in places where it was restricted a less mortality resulted. It is also doubtless true that inoculation by opening up a new line of thought as to the preventibility of disease, paved the way for the subsequent reception of vaccination, and at the same time the knowledge that disease could be thus propagated at pleasure must have suggested the possibility of its being controlled at will. To the continuance and universal acceptance of Sydenham's doctrine of "epidemic constitution of the "atmosphere," Haygarth attributed the persistence of small-pox. 10,738.

23. We also learn on the authority of Haygarth how great was the contrast, in respect of small-pox prevalence, between towns and country districts. Thus, in Kent, where inoculation was cautiously avoided, he quotes figures to show that last century the annual small-pox mortality did not exceed one in 20,000. From Sussex, too, he had evidence pointing to a similar experience. Writing in 1793, he adds, "How far this wonderful Vol. IV., App. 1, p. 398.
"exemption from the mortality of the distemper extends through the South of England "I cannot determine. The facts here related in regard to both Kent and Sussex are "taken by accident, and I have no reason to believe them extraordinary in these counties. "But no fact in any degree similar to them can be produced in this neighbourhood "(Chester), nor probably in any other where inoculation is freely allowed, and where, "at the same time, the casual contagion is permitted to make its destructive progress "without any kind of interruption. If the feeble, irregular, unconnected, and un-"authorised efforts of individuals can prevent so much mischief, *how much more "benefit might reasonably be expected from the united, systematic, and concerted regulations "of the whole island aided and strengthened by legal premiums and punishments*." (Italics ours.)

In 1763 small-pox was unusually severe in Paris, and upon inquiry it was determined that this was owing to increased infection from inoculation, a decree was accordingly issued prohibiting the practice in that city. It is stated by Moore and others that in Spain inoculation never became a general practice, and that no other country in Europe last century suffered so little from small-pox.

24. In estimating the influence of the practice of inoculation on the amount of and mortality from small-pox in a community regard must be had to several factors. If we accept the common view that one attack of the disease, though artificially administered, affords a considerable amount of immunity against a future attack, though perhaps not influencing the severity should such attack occur, the universal practice would, in view of the usually greater mildness of the inoculated disease, determine a low small-pox death rate. Inasmuch as such universality of the practice never was and never could be attained, the extent to which it failed ensured (except in the rare cases where special isolation of the inoculated was secured) the constant presence of infected persons who were centres of contagion to the susceptible. There is plenty of evidence, not only last century but of more recent dates that inoculation has been the means of introducing and spreading small-pox in localities where the population was largely composed of susceptible persons. The effect of inoculation would in any particular time or place depend not only on the proportion of the inoculated to the susceptible, but also on the condition of things obtaining as regards the diffusion of the contagion independently of this particular mode of its propagation. Thus, if through habitual disregard of contagion small-pox patients were suffered to mix freely with those liable to the disease, the effect of any such superadded source of contagion as inoculation might well be inconsiderable. In a town where the disease had been long naturalised, and no particular measures taken to prevent it, we should not expect to find a very marked augmentation of the disease by even the partial practice of inoculation. In the case of isolated towns or villages removed from the more populous centres of human intercourse, and in which accordingly small-pox came rarely and epidemically, the introduction of inoculation might be expected to establish and spread the disease. Moreover, the habitual and systematic carrying on of the practice, without precautions, in a large town by ensuring the endemicity of the disease, and, as it were, making it indigenous, would in the case of small-pox tend to mask and obscure any influences at work of a countervailing character as regards the public health. 10,492. 2886–7. 3182–4. 8128.

25. This is in fact what we find when we examine such figures as are available for determining the influence of inoculation on the prevalence of and mortality from small-pox, as, for instance, the London Bills of Mortality. Whether we consider the horribly insanitary conditions with the attendant overcrowding, or the disregard of precautions against contagion, it would probably be difficult to conceive conditions more favourable to the spread and fatality of small-pox than those which obtained in London in the first three quarters of last century. In this respect it is probable London was as bad as or even worse than other large European towns. Small-pox and other infectious fevers were allowed to run riot, and Bernouilli's calculation, derived from the experience of such places at such times, to the effect that 60 per cent. of those born took small-pox was probably not far wrong. The introduction of even partial and indiscriminate inoculation was not likely to, and in fact did not, increase to the extent which might otherwise have been expected the heavy toll that small-pox already exacted. Thus the figures from the London Bills show that in the first quarter of the 18th century, when inoculation had scarcely begun to be practised in London, the deaths from small-pox were 44,306 out of 586,270 total deaths, or 7·6 per cent. In the following quarter, when a certain amount of inoculation was carried on, especially towards its close, small-pox was responsible for 49,941 deaths out of 660,800, or again 7·6 per cent. In the third quarter, when inoculation had become an established custom, 56,690 out of 549,891 deaths, or 10·3 per cent., were ascribed to small-pox, In the last quarter of the 18th century, although the total deaths had greatly fallen, under the influences to which we have already alluded, the deaths from small-pox still constituted 9·2 per cent. of the whole (45,428 out of 493,309). It cannot be denied that the proportion of small-pox deaths to deaths from all causes was greater last century in London after the introduction of inoculation than it was before, though it is also true that the death rate in proportion to the estimated population from all causes and from small-pox showed signs of improvement during the last quarter of the 18th century. 11,004.

26. The Committee of the House of Commons which reported on Jenner's petition stated:—"As a comparison between this new practice and the inoculated small-pox "forms a principal consideration in the present inquiry, some facts with regard to the "latter engaged the attention of your Committee, and in the supplement are inserted "statements of the mortality occasioned by the small-pox in 42 years before inoculation "was practised in England, and of the 42 years from 1731 to 1772; the result of which Vol. 1. App. p. 95.

" appears to be an increase of deaths amounting to 17 in every 1,000; the general
" average giving 72 in every 1,000 during the first 42 years, and 89 in the 42 years
" ending with 1772, so as to make the whole excess of deaths in the latter period 1,742.
" The increase of mortality is stated by another witness (No. 10) to be as 95 to 74,
" comparing the concluding 30 years with the first 30 of the last century, and the
" average annual mortality from small-pox to have been latterly about 2,000; for
" though individual lives are certainly preserved, and it is true that a smaller loss
" happens in equal numbers who undergo the small-pox now than there was formerly,
" yet it must be admitted that the general prevalence of inoculation tends to spread
" and multiply the disease itself; of which, though the violence be much abated by
" the present mode of treatment, the contagious quality remains in full force."

27. Calculations made by de Haen, Rast, Heberden, and others confirmed the belief that inoculation, as practised in London, kept going a constant source of contagion and increased the prevalence of small-pox. Dr. Heberden, writing in no controversial spirit, thus summed up the case in 1801:—" The inoculation of the small-pox having been 10,515. Vol. I., App., p. 66.
" first used in England since the beginning of the eighteenth century, and having
" been now for many years generally adopted by all the middle and higher orders of
" society, it becomes an interesting inquiry to observe, from a review of the last
" hundred years, what have been the effects of so great an innovation upon the
" mortality occasioned by that disease. But, however beneficial inoculation prove to
" individuals, or indeed to the nation at large, the Bills of Mortality incontestably
" show that in London more persons have died of the small-pox since the introduction
" of that practice. The poor, who have little care of preserving their lives beyond
" the getting their daily bread, make a very large part of mankind. Their prejudices
" are strong, and not easily overcome by reason. Hence, while the inoculation of the
" wealthy keeps up a perpetual source of infection, many others, who either cannot
" afford or do not choose to adopt the same method, are continually exposed to
" the distemper. And the danger is still increased by the inconsiderate manner in
" which it has lately been the custom to send into the open air persons in every stage
" of the disease, without any regard to the safety of their neighbours. It is by these
" means that, while inoculation may justly be esteemed one of the greatest improve-
" ments ever introduced into the medical art, it occasions many to fall a sacrifice to
" what has obtained the distinction of the natural disease. This must always be an
" objection against making any great city the place for inoculation until the practice
" is become universal amongst all ranks of people. Out of every thousand deaths in
" the Bills of Mortality, the number attributed to the small-pox during the first 30
" years of the eighteenth century, before inoculation could yet have had any effect
" upon them, amounted to 74. During an equal number of years at the end of the
" century, they amounted to 95. So that, as far as we are enabled to judge from
" hence, they would appear to have increased in a proportion of above five to four."

28. We agree with those witnesses who are of opinion that inoculation as practised in this country and many parts of Europe last century did tend to increase the prevalence and mortality from small-pox, that it introduced the disease into places that in all probability would have remained exempt from it, and in some large towns like London it tended to keep the contagion alive and to make the disease endemic. It appears, however, from the Bills that its introduction did not at once or very materially increase the mortality from small-pox in London. This was doubtless owing to the fact that it was scarcely possible to make matters much worse then than they were before in regard to the number of small-pox deaths. 282.

29. We are led to believe that but for the disease being kept alive by inoculation, the improvement of the public health which set in towards the end of the 18th century, in obedience to the causes to which we have alluded, would have brought about an earlier and greater decline of small-pox mortality. The mere substitution of a non-contagious process like vaccination for the old inoculation in a population of whom some 80 per cent. or more had acquired naturally or artificially such protection as previous small-pox affords would have a striking effect upon the small-pox death rate by reducing the liability to infection of the remaining susceptible.

30. We think there can be no doubt that, speaking generally, in London last century, whether from the indiscriminate practice of inoculation or from the habitual indifference which permitted small-pox to run riot with little, if any, restriction, the great bulk of persons suffered from small-pox in childhood and acquired such protection as an attack of small-pox affords. The deaths from small-pox each year were chiefly those of young children or newcomers who were exposed to the constant sources of infection always kept going, and to the effects of which they had not been rendered immune. It is clear

that any changes which would have the effect of reducing the chances of infection would diminish for the susceptible the prospects of attack and death by small-pox; while those who had acquired natural or artificial immunity would constitute to that extent a protected class. In so far as vaccination (after the first mistakes of Woodville and Pearson) substituted a non-infectious procedure for the old inoculation, to that extent, and apart from any question of its affording any immunity, it should by checking a fertile cause of the diffusion of small-pox bring about indirectly a reduction of mortality from that disease. Great as such influence must have been, and great as were the efforts which were now for the first time made to restrict the spread of small-pox—by efforts directed against contagion—there were in addition those other influences at work during the last quarter of the 18th century to which we have already alluded, influences which have been continued and intensified during the present century, and which in our opinion must be credited with a considerable share in the reduction of small-pox.

31. Attention has also been directed to the influence of states of peace and war upon small-pox epidemics. Small-pox as well as typhus has not uncommonly been especially prevalent and fatal among armies and nations in a state of war. The privations, crowding, interruptions of regular sanitary organisation associated with sieges and the
7994-8021. field of battle are calculated to propagate infectious disease, and such disease under such circumstances is likely to spread far and wide, and regardless of national boundaries to extend to other nations besides those actually engaged in war. The experience of the last century as well as the present indicates a relationship between war and small-pox, and it is not improbable that the fall of small-pox in the earlier part of this century in Europe may have been due in some measure to transition from war to peace, and that certain recrudescences of small-pox during the latter part of the century may have been connected with wars, notably in the case of the Franco-German war of 1870–71.

32. The lull in small-pox which characterised the early years of this century was, then, probably largely due to the cessation of inoculation in a population whose sanitary condition was beginning to improve, as evidenced by the falling death rate from all causes and from fevers, and who had for the most part received naturally or artificially such protection as previous small-pox is capable of affording. In the 80 or 90 years which separated the introduction and abandonment of inoculation there had been enormous improvements in the healthiness of large towns, the influence of which, upon small-pox in particular, had been interfered with and masked by the propagation of this disease artificially.

33. When inoculation of the small-pox became more general in accordance with the method adopted by the Suttons, failure of the operation was in some cases attributed to the patient having previously suffered from cow-pox. Jenner, who was practising at Berkeley in Gloucestershire, became impressed with this belief. He found, however, that some who had undergone the cow-pox, on inoculation with the small-pox, felt its influence just the same as if no disease had been communicated to them by the cow. This experience was shared by the medical men in his district. Jenner then proceeded to draw distinctions between what he called the true cow-pox, and other varieties of "spontaneous eruptions" on the teats, which he classed together as spurious cow-pox. The true cow-pox, *i.e.*, that which was protective, he traced in origin to the heel of a horse suffering from the Grease.

34. Jenner's first writing on the cow-pox was a communication intended for the Royal Society in 1797, the original of which, it would appear, exists in manuscript in the library of the Royal College of Surgeons. The communication was not printed in the Philosophical Transactions, but was returned to Jenner, and, with additions, was published in 1798 as "An inquiry into the causes and effects of the Variolæ Vaccinæ." The original paper asserted that "matter of various kinds when absorbed into the " system may produce effects in some degree similar; but what renders the cow-pox " virus so extremely singular is, that the person who has been thus affected is for " ever after secure from the infection of the small-pox; neither exposure to the " variolous effluvia nor the insertion of the matter into the skin producing this " malady."

35. Jenner states that the observations which led to the publication of his inquiry extended over 25 years. The original paper for the Royal Society contained an account of only one case of vaccination (*i.e.*, inoculated cow-pox); the other instances cited being three cases of casual infection from the grease of the horse, and 10 cases of casual infection from the cow.

Dealing with the 10 cases of "casual cow-pox" first, it must be premised that inasmuch as the disease conveyed by the cow had in nearly all the cases taken place many years before they came to Jenner for inoculation with small-pox, it would be impossible to decide what kind of "cow-pox" it was from which they had suffered. Again, it would appear that these 10 cases had been collected from an experience of inoculation extending over some years. One case was inoculated by Jenner in 1778, another in 1791, another in 1792, two in 1795, three in 1797, and in two the date is not given. The effect of the inoculation of small-pox as applied by Jenner in these cases is recorded as local inflammation, often described as an "efflorescence," in some amounting to "erysipelas," but without any constitutional variolous symptoms. In the three cases of casual horse-grease, the date of their infection is not given. Two of these were inoculated with small-pox, in one case six years later, in the other, "some years after," with the result of a slight inflammation only in the first case, and in the second a few eruptions on the forehead which did not advance to maturation. The third horse-grease case on exposure to infection of small-pox caught the disease, the nature of which was verified by successful inoculations in others. Jenner quotes this last case in support of his contention that the virus from the horse could not be relied upon until it had been communicated to the nipple of the cow and thence to the human subject.

36. We will return presently to the only case of vaccination mentioned in Jenner's original paper. The other cases may be thus summed up. In the course of several years' inoculation practice, Jenner collected 10 instances of insusceptibility to small-pox in persons who stated that many years or months previously they had suffered from a disease which they called the cow-pox. He added three cases of grease in the human subject, only one of which gave evidence of insusceptibility to small-pox.

37. Jenner's "Inquiry," published in 1798, reproduced the above cases, and added others. The additions were as follows:—

(1.) A case of casual cow-pox (Sarah Nelmes) from whom lymph was taken for the vaccination of Phipps, the only case of vaccination alluded to in the original paper. She does not appear to have been subjected to the variolous test. (2.) A case of insusceptibility to inoculation in 1792 who was reported to have had cow-pox 10 years previously. (3.) The paupers of Totworth, having been inoculated in 1795 by Henry Jenner, eight who proved insusceptible were reported to have had the cow-pox "at different periods of their lives;" one of them had been attended with the cow-pox in 1782 by Jenner himself. (4.) Three cases of casual horse-grease, in servant men of a farm, two of whom had had small-pox previously; they do not appear to have been submitted to the variolous test. (5.) A child, John Baker, was inoculated with horse-grease from the hand of one of the foregoing. The pustule appears to have shown a disposition to run into an ulcer, and "the boy unfortunately "died of a fever at a parish workhouse" soon after this experiment was made, and before he could be submitted to the variolous test. (6.) Several children and adults were vaccinated directly or indirectly from a cow which had been infected with horse-grease. Three of these were submitted to the variolous test (Summers, Barge, and Pead). The reason why the test was not applied to others is thus stated by Jenner:—"After the many fruitless attempts to give the small-pox to those who had had the "cow-pox, it did not appear necessary, nor was it convenient to me, to inoculate the "whole of those who had been the subjects of these late trials."

38. The original paper and inquiry of Jenner taken together therefore furnish us with four cases in which the human subject had been intentionally cow-poxed, and to whom the "variolous test" had been subsequently applied, viz., Phipps, Summers, Barge, and Pead. The facts in regard to these four cases, as given by Jenner, are summarised in the following table:—

Name.	Age.	Date of Vaccination.	Date of Inoculation.	Result.
1. Phipps -	8 years	May 14, 1796 -	1. July 1, 1796 - 2. "Several months afterwards."	"1. The same appearances were observable on the arms as we commonly see when a patient has had variolous matter applied, after having either cow-pox or the small-pox." "2. No sensible effect was produced on the constitution."
2. Summers -	5 years	Mar. 16, 1798 -	(No date), but before June 21, 1798.	"He was inoculated with variolous matter from a fresh pustule; but, as in the preceding cases, the system did not feel the effects of it in the smallest degree."

Name.	Age.	Date of Vaccination.	Date of Inoculation.	Result.
3. Pead -	8 years	Mar. 28, 1798 -	(No date), but before June 21, 1798.	Inoculated by Henry Jenner, who reported :— "I have inoculated Pead and Barge, two of the boys whom you lately infected with the cow-pox. On the second day the incisions were inflamed and there was a pale inflammatory stain around them. On the third day these appearances were still increasing, and their arms itched considerably. On the fourth day the inflammation was evidently subsiding, and on the sixth it was scarcely perceptible. No symptoms of indisposition followed."
4. Barge -	7 years	Apr. 19(?) 1798		

In these four cases, therefore, subsequent inoculation within a few weeks or months gave results upon which Jenner based the claim that insusceptibility to small-pox was conferred by inoculation of cow-pox.

39. The value of this "variolous test," *i.e.*, the failure of inoculation of small-pox to produce the disease in those who had had the cow-pox, as a test of acquired immunity has been disputed. To assess its value, it is necessary to know what results were likely to occur when the test was similarly applied to those not cow-poxed.

4895, 5008, 4850. 40. It is difficult to arrive at any numerical estimate of the proportion of cases of inoculation, in the modified form in which it was practised at the end of last century, in which little or no eruption of pustules appeared upon the body. There can be no doubt that such cases were more common in the practice of the Suttons and of Dimsdale than in the hands of the earlier inoculators. The cause of the mildness has been variously attributed to drugs, to open-air treatment, to taking the lymph early, to using lymph from the "mother pustule," &c., but whatever the cause of the mildness, and even when there was only a local pustule, or merely local inflammation, and constitutional symptoms short of any general eruption, the operation was regarded as effective, and the patients were held by some inoculators to have gone through the small-pox, and acquired protection. Adams, in 1805, operating with a mild variety of small-pox, succeeded in carrying on inoculation, in some cases from arm to arm, in such a form that the results on the arm were described as of "legitimate vaccine appearance"; 11,144. and in half his cases there was no eruption. This and other attempts by Adams, at 11,141. the Small-pox Hospital in the early years of this century, to perpetuate a favourable small-pox, were interrupted by the prejudices of parents in favour of secondary pustules; 10,435. although it was urged that "before the discovery of cow-pox, the inoculation of "small-pox was sometimes only followed by a pustule at the arm, with the attendant 11,150. "fever." Adams' experiments of arm-to-arm variolation, giving "vaccine" results, Vol. I. App., p. 68, footnote. received subsequent corroboration from those of Guillou and Thiele. This mild variety of small-pox had been observed by Jenner, and in 1789 he appears to have used it 25,249. under the name of swine-pox for the inoculation of his son; and he held that by arm-to-arm inoculation under certain conditions a mild small-pox might be produced at will.

41. The fact that small-pox could be inoculated under certain conditions so as to produce minimum results has an important bearing—

1. Upon the interpretation to be placed upon the "variolous test" as applied to vaccinated persons; and
2. Upon the nature of a series of inoculations by Woodville at the Small-pox Hospital with what was called cow-pox, which undoubtedly did much to found the belief that vaccination secured immunity towards small-pox.

42. In regard to the first point, it will be necessary to note, in cases where cow-poxed persons were subjected to inoculation to test their immunity, what was the amount of the local and constitutional results to be expected from the method of inoculation adopted, and how far the actual results differed from those obtained in persons who had not previously had the cow-pox. Whether resistance to the "variolous test" implied protection against natural or epidemic small-pox must be reserved for consideration later on. In regard to Jenner's own cases we find in his "Inquiry," after alluding to the mild variety of small-pox, which Adams termed "pearl-pox," he goes on to speak of "the attention that was paid to the state of the variolous matter previous

" to the experiment of inserting it into the arms of those who had gone through the " the cow-pox. This," he says, " I conceive to be of great importance in conducting " these experiments, and were it always properly attended to by those who inoculate " for the small-pox, it might prevent much subsequent mischief and confusion."

43. In one case in the "Inquiry" Jenner does make mention of the source of the variolous matter which he used for his test. In Case 3 (Phillips), he says, " It " was taken from the arm of a boy just before the commencement of the eruptive fever, " and instantly inserted." It was therefore arm-to-arm variolation from an early " mother-pustule." In regard to the two cases of vaccination by Jenner set out in the foregoing table, the following statements as to the variolation are made :—In Phipps's case " he was inoculated with variolous matter immediately taken from a pustule." In Summers's case " he was inoculated with variolous matter from a fresh pustule." It is not possible to say, therefore, that in these two cases the method employed differed from that adopted in Case 3 (Phillips).

Now the results obtained in these cases were hardly less than the results obtained in some cases by Dimsdale and other inoculators in persons who had not previously been cow-poxed, but who were nevertheless regarded as having thereby received the infection to an extent sufficient to establish immunity. Vol. iv., App. 1, p. 398.

44. It appears from Jenner's later publications and correspondence that he sometimes met with more definite results from the insertion of variolous matter in the arms of 11,780–1. those who had been cow-poxed than in the cases mentioned in the Inquiry ; in some cases a pustule or vesicle resulted, capable of communicating small-pox, and often attended with extensive inflammation and sometimes by a slight eruption. (Baron, 254. Vol. I., 445, Medico-Chi. Trans., Vol. I.) It is also clear that cow-pox lymph from one of the same stocks used by Jenner (the Stonehouse cow-pox), and in his hands 11,966. stated to be protective, in the hands of neighbouring surgeons, when submitted to 11,975. the variolous test, failed to prevent the development of inoculated small-pox in the usual way. Jenner's Inquiry was read with interest by leading medical men in this country, and for the most part appears to have been favourably received. Haygarth, Percival of Manchester, Ingenhousz (who was on a visit to England), and others asked for more evidence of the alleged protection. Moseley, who led the opposition to the practice, doubted whether the vaccinated would stand proof against epidemic small-pox, and declared the protection to be non-specific and temporary. Dr. Beddoes, of Bristol, who was not unfriendly to Jenner, thus summed up the position of affairs at the beginning of 1799, in a letter to Professor Hüfeland, of Berlin :—" You know Dr. " Jenner's experiments with the cow-pox. His idea of the origin of the virus appears " to be quite indemonstrable, and the facts which I have collected are not favourable to " his opinion that the cow-pox gives complete immunity from the natural infection of " small-pox. Moreover, the cow-pox matter produces foul ulcers, and in that respect " is a worse disease than the mildly inoculated small-pox." (Hüfeland's Med. Journal, 1799.) He adds that experiments were to be carried out at the London Small-pox Hospital.

45. Thus the matter stood when, in January 1799, cow-pox was discovered in a dairy in the Gray's Inn Lane, London, and attracted the attention of the leading medical men in town, and became the subject of experiments on a large scale by Drs. Woodville and 11,182. Pearson at the Small-pox Hospital.

Woodville published the results of his experiments in May 1799, and Pearson in March of the same year distributed the hospital lymph to some 200 practitioners at 11,185. home and abroad.

46. This was the starting point of the practice of " vaccination ; " for Jenner had lost his strain of lymph. Woodville's cases merit careful attention, as from their number and detail, and from the fact that he had submitted nearly all of them to the variolous test within three months of their " vaccination," and found they resisted it, they produced a profound impression on the mind of the public and the profession. In July 1800, 33 of the most eminent physicians and 40 distinguished surgeons of the metropolis signed a declaration to the effect that " those persons who have had the cow-pox are " perfectly secure from the future infection of the small-pox, and that the inoculated " cow-pox is a much milder and safer disease than the inoculated small-pox." (Morning Herald, July 19th, 1800.)

47. We are unable to find in these early days of vaccination any other evidence on a scale at all comparable to that of Woodville in confirmation of the views advanced by Jenner ; and it is clear that professional authority declared for vaccination mainly upon the experience of Woodville and Pearson.

48. We have received a great deal of evidence on the subject of the nature of the lymph used and distributed so widely at home and abroad by Woodville and Pearson. Its effects differed from those of inoculated cow-pox as described by Jenner, and as observed since, in that in the majority of the cases detailed in Woodville's Reports pustules
4878. appeared on the body similar to small-pox pustules; indeed, Woodville spoke of the
25,234. cow-pox as an eruptive disease, in one case even as confluent, and as sometimes con-
25,246. tagious. It is now not disputed that these pustular cases, three-fifths of the whole,
11,776. were cases of small-pox, and that their resistance to the variolous test accordingly proved nothing as to the alleged protection conferred by cow-pox. How was this
11,239. source of error introduced, and what was the nature of the remaining two-fifths of the cases?

4874. Some, at any rate, of the "vaccinations" appear to have been performed within the precincts of the small-pox hospital, and it has been suggested that the infection was aërially conveyed.

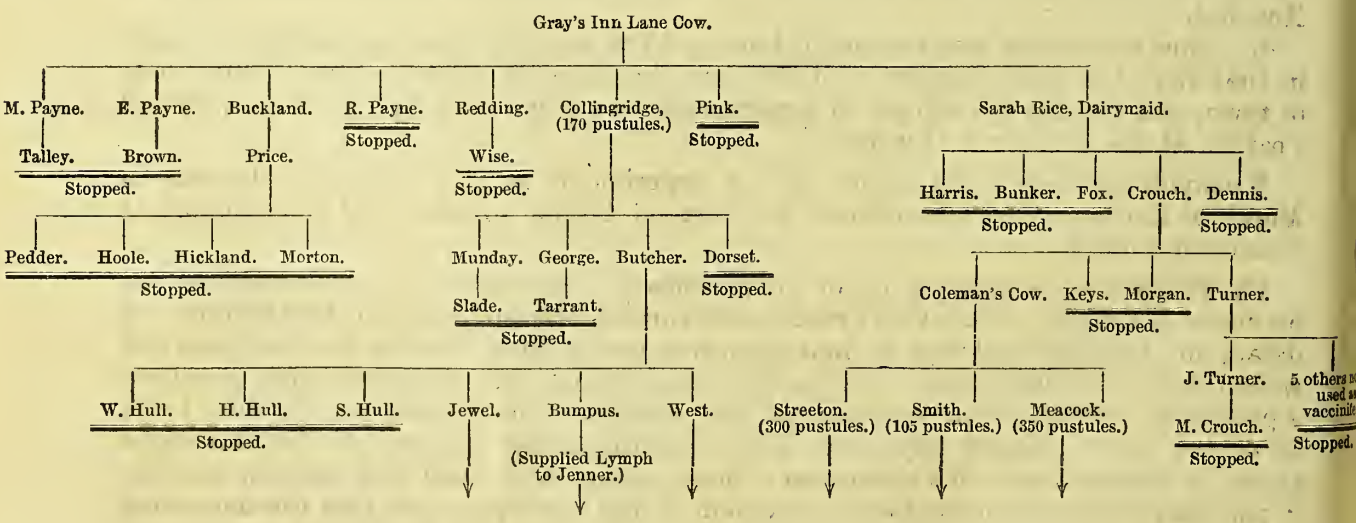
In several of the first cases (Collingridge, R. Payne, Redding, Pink), small-pox matter was inoculated on the "vaccinated" patient a few days after the cow-pox, and this may have led to contamination.

49. But one of the very first cases (Buckland) which Woodville believed he had only inoculated with matter "in a purulent state" direct from the cow exhibited all the
25,224. symptoms (including a pustular eruption commencing on the inoculated arm), which make it in the highest degree probable that this patient was in fact variolated when he was supposed to have been vaccinated.

50. The three persons (Streeton, Smith, and Meacock) inoculated from a cow (Coleman's) which had been inoculated at one remove from a pustule on the hand of a dairymaid at the Gray's Inn Lane Dairy, similarly at the proper time developed small-pox in a way highly suggestive of its having been inoculated at the place and time of what purported to be vaccination; from these three persons much of the lymph was taken for the subsequent inoculations. The only other case (Collingridge), inoculated direct from the cow, used to any extent for subsequent inoculations, was purposely variolated on the fifth day of her vaccination; it is impossible to establish that the first inoculation in her case was in fact that of cow-pox, and it may well have been, as in the first case mentioned above (Buckland), that what purported to be vaccination was in truth variolation. Her own subsequent symptoms, as well as the results on those inoculated from her arm, support such supposition. Indeed, Woodville's lymph passed exclusively through those suffering from small-pox, for he seems to have avoided carrying on matter from those who exhibited only the local pustule as the result of their inoculation from the Gray's Inn Lane cow, or dairymaid.

Vol. VI. App. p. 619-623.

PEDIGREE of WOODVILLE'S "HOSPITAL MATTER," showing how the strain continued only through subjects with small-pox pustules.



The absence of pustules in two-fifths of the cases does not prove these to have been of other than variolous origin. Woodville's tables show that when he inoculated from pustules on the body (*i.e.*, secondary small-pox pustules, as they are now admitted to have been) he yet in several instances obtained only a local pustule on the arm as the result.

Indeed, on the assumption that Woodville was dealing with arm-to arm variolation, 4895.
he only succeeded in obtaining what inoculators before and since claimed to have 25,249.
obtained when working with undoubted small-pox matter. (Baron, I., 245.) 25,265.

51. It is, therefore, probable that the whole of Woodville's 500 cases which appeared
to confirm Jenner's thesis, and secured the support of professional authority, were in 25,270.
fact only a series of mild variolations. It is certain that they were, from first to last,
contaminated with small-pox. We agree with Professor Crookshank that in either
case they must be set aside for the purpose of arriving at a decision as to whether 12,089.
uncontaminated cow-pox confers immunity towards small-pox. Woodville's cases, 11,813.
therefore, which did so much to establish the practice of vaccination, and which for
nearly a century have been cited as demonstrating the truth of Jenner's doctrine, must
be rejected as furnishing false evidence, and valueless as a scientific experiment.

52. The hospital matter of Woodville and Pearson, which produced eruptions of
pustules and was therefore variolous, was the great source from which in the 11,185.
years 1799 and 1800, and perhaps later, the practice of "vaccination" was started.
According to Baron (I. 312), "It is impossible now to deny the fact that this *impure*
"matter was really disseminated over many parts of England, and also on the continent, 11,764.
"in place of that of the true variolæ vaccinæ." Moreover "the eruptions, which
"attended many of the early cases of vaccination in London, were unfortunately 11,192–
"also propagated in different parts of the country, where the *contaminated* matter had 11,204.
"been distributed by Dr. Pearson" (Baron, I. 339). Moore (History of Vaccination,
p. 36) says "Variolous matter, under the denomination of vaccine lymph, was spread
"widely through England, and transported to Germany, and even to the Island of
"Madeira, where a physician described the vaccine as a pustular disease."

Jenner's original lymph had been lost, and though repeatedly applied to for matter 11,978.
in the latter part of 1798, he had none to send.

53. On February 15, 1799, Jenner was supplied with Woodville's Hospital matter from 11,847.
a patient (Bumpus) who had 310 variolous pustules, and in the first case inoculated by 25,276.
Jenner with this matter pustules appeared on the face, and in the second case, though there was no eruption, the local pustule assumed "the variolous character," and the areola was studded with minute vesicles. Jenner kept up a stock of this matter from arm to arm, and when applied to by Ring for cow-pox matter, Jenner in September 1799 sent him matter derived from the Woodville stock, explaining that "when I had "the pleasure of receiving your letter there was no cow-pox matter here in a fit "state to send you" (Baron, I. 358, and Crookshank, II. 184–6). It would therefore appear that if at that time Jenner possessed any other strain than the hospital matter, such as the Kentish Town lymph alluded to in section 27 of our colleagues' report, it was not fit for use.

54. Writing to Moore in 1812 Jenner accused Pearson of "spreading the small-pox
"through the land, and calling it the cow-pox" (Baron, II. 383). The medical journals 11,192–
of the time furnish evidence that the lymph of Woodville and Pearson, when used in 11,204.
the country, produced variolous eruptions in some instances even proving contagious 25,303.
as it had done in London. Those thus inoculated also proved refractory to the variolous
test.

55. It is true, as stated in sections 20, 23, and 27 of the majority report, that Woodville speaks of having at various times procured lymph from different cows, and with it inoculated patients in the hospital ("Observations on the Cow-pox," 1800), but he adds, "the effects of all the matter I tried were perfectly similar; and pustules proved "to be not less frequently the consequence of these trials than with those made of the "matter formerly employed."

56. In the report of the Vaccine-Pock Institution, 1803 (page 4), it is stated that it
was from two sources *only*, viz., the Gray's Inn Lane lymph taken by Woodville and 25,219.
Pearson, and the Marylebone lymph taken by Pearson, that the matter used in London
and the provinces in or about 1799 to the extent of some four or five thousand
inoculations, was derived.

57. In the letter which Pearson sent on March 12, 1799, enclosing a thread imbued
with matter, to 200 practitioners, he stated that "in many of the cases eruptions on 11,185.
"the body appeared, some of which could not be distinguished from the small-pox."

This same "hospital matter" was also widely distributed abroad, to Paris, Berlin,
Vienna, Geneva, Hanover, and to Portugal and America. 11,190.

58. We read of this matter producing variolous eruptions in distant places as it had done at home, and in some cases the variolous test showed a refractoriness had been acquired. The hospital matter of Woodville and Pearson would appear to have been the

chief source of the first stocks of lymph used on the Continent and in America. It is
11,204. true Stromeyer of Hanover also received matter from Jenner, but as it produced tedious ulcerations he gave it up in favour of Pearson's stock, which he says "produces "frequently an eruption of small pimples." We have been unable to trace the extensive use of any matter sent abroad from this country in these early years which can be clearly shown to have had other origin than the stock of Woodville and Pearson.

59. Fresh stocks of lymph were later on raised by Sacco and others from various sources, such as spontaneous cow-pox, horse-grease, and sheep-pox. Even if we accept Sacco's somewhat sensational accounts of his work we do not find in it corroboration of the thesis of Jenner that cow-pox derived from the grease of the horse is possessed of specific efficacy such as is not possessed by spontaneous cow-pox or the grease as taken from the horse. And as to the matter used by De Carro and sent by him to the East and used so extensively in India, which our colleagues suggest (sect. 27) establishes the use of cow-pox lymph abroad of other than British origin, we learn from de Carro:—"The source of our cow-pox is partly British, and partly originating from the *grease* "of a horse at Milan, without any intervention of a cow. The effect was so similar in "every respect that they were soon mixed, that is to say, that it was impossible to say, "after several generations, and in the hands of innumerable practitioners, what was "equine and what was vaccine. The whole British settlements in India have been "*equinated;* for the first liquid drop which I sent 25 years ago to India was the second "generation of Milanese equine, transplanted at Vienna." (Letter from de Carro to Monro, Edinburgh Journal of Medical Science, Vol. I., 1826, p. 284–5.)

11,826. 60. Apart from the vague statements of Marshall, which must be received with
11,680. reserve, we are unable to find in the early days of vaccination any large body of
11,847. definite evidence sufficient to establish the contention of Jenner, that cow-pox, and
12,002– especially that of equine origin, affords, when conveyed to man, security from the
12,018. future infection of small-pox.

61. Whatever may have been the nature of the matter used and so widely distributed by Woodville and Pearson, and even if we must regard it all as derived from small-pox, it seems that after a time, whether from attenuation or dilution of the original matter, or the selection of mild cases, or from other causes, the operation gradually ceased to be followed by pustular eruptions, was no longer infectious, and came to
11,204. assume the local phenomena now observed in ordinary vaccination.

62. It is clear, therefore, that the bulk of the cases of "vaccination," which in the first few years of the practice were shortly afterwards submitted to the variolous test, and of which record remains, had been inoculated with the hospital lymph of Woodville and
11,795. Pearson. It would have been satisfactory to find evidence on a similar scale, and recorded with equal detail, of cases inoculated with cow-pox matter pure and simple, and submitted at subsequent periods to the variolous test or epidemic exposure, and showing immunity towards small-pox. Though much research has been directed
12,087. to this point, it appears to have been almost entirely barren of result.

63. We shall adduce reasons later on for thinking that under the one name of "vaccination" matter derived from various sources, and of diverse origins, has been introduced at different times. It is now no longer possible to trace or distinguish these. We therefore, in using the term "vaccination," must be held to employ it colloquially, and not exclusively as an equivalent for cow-poxing.

64. In the early years of this century it was not unnaturally argued that the renuncia-
11,853. tion of inoculation was a necessary consequence of the approval of vaccination, and the milder operation was authoritatively urged in substitution of the old practice. In 1808 Jenner contributed a paper to the "Medico-Chirurgical Transactions," in which, after guarding those who thought fit to inoculate after vaccination from unnecessary alarm should a pustule, fever, and a slight eruption ensue therefrom, he concluded thus: "At the commencement of vaccination I deemed this test of security necessary; "but I now feel confident that we have one of equal efficacy, and infinitely less "hazardous, in the re-insertion of the vaccine lymph." Bryce about the same time advocated the same practice, which was adopted by many, and came to be spoken of as "Bryce's test." (Practical Observations on the inoculation of the cow-pox, 1809.) The significance of this test of re-vaccination we shall discuss later on in connexion with the modern development of that practice.

65. Though in his first essays Jenner merely suggested vaccination as a substitute, in certain cases, for inoculation, there can be no doubt that the claim he originally made for vaccination was one of complete and permanent protection against small-pox. Jenner in his "Inquiry" observed "what renders the cow-pox virus so extremely singular

" is, that the person who has been thus affected is for ever after secure from the " infection of the small-pox."

66. Cases in which small-pox had occurred after cow-pox had frequently been pressed upon Jenner's attention (Gregory's "Eruptive Fevers," p. 208), and in his third publication in 1801 Jenner thus alludes to these objectors :—" Some there are who " suppose the security from small-pox obtained through the cow-pox will be of a " temporary nature only. This supposition is refuted, not only by analogy with " respect to the habits of diseases of a similar nature, but by incontrovertible facts, " which appear in great number against it." He claimed that it had been uniformly found that "the human frame, when once it has felt the influence of the genuine cow- " pox in the way that has been described, is never afterwards, at any period of its " existence, assailable by the small-pox." In his evidence before a Committee of the House of Commons in 1802 he maintained that "it now becomes too manifest to admit " of controversy, that the annihilation of the small-pox, the most dreadful scourge of " the human species, must be the final result of this practice." In his petition to the House of Commons he states that he had discovered that "the cow-pox admits of " being inoculated on the human frame with the most perfect ease and safety, and is " attended with the singularly beneficial effect of rendering through life the persons so " inoculated perfectly secure from the infection of the small-pox." (Baron, I. 490.) 1st Report, App., p. 94.

67. It was not long, however, before cases of small-pox in those who had been vaccinated began to crop up. Goldson of Portsea published some cases in 1804; Moseley, Birch, and others called attention to failures in London, and in 1809, Brown of Musselburgh published a work containing a number of cases of post-vaccinal small-pox which raised doubts as to the efficacy of the practice and suggested that its powers at best were only temporary. There were also reports from abroad of small-pox subsequent to vaccination, especially in Geneva. (Baron, I. 338.) 25,336. 25,472. 11,853.

68. Further failures in London, and particularly one in the family of a nobleman in 1811, excited some opposition to the practice. In 1818 Dr. Monro of Edinburgh published a number of cases observed by himself and others in which small-pox in its perfect form succeeded to vaccination in its perfect form. Small-pox continued to be epidemic in Scotland, attacking many hundreds of the vaccinated in various degrees, and Dr. Thomson wrote a book in 1820 on the varioloid type of the disease. In 1819, nineteen, and in 1825, 147, vaccinated persons were admitted with small-pox into the London Small-Pox Hospital.

69. Other countries of Europe suffered severely from small-pox about this time, and the theory that ascribed to vaccination the reduction of small-pox in the earlier years of the century, in some places to the point of extinction, received a rude shock. In 1828 a severe epidemic broke out at Marseilles, and 2,000 vaccinated persons caught the disease. Vol. I., App., p. 74.

70. In Copenhagen, where the absence of fatal small-pox from 1811 to 1823 had been confidently attributed to the introduction of vaccination, in 1824 there were 41 deaths from small-pox, and in 1835, 434, or 11·2 per cent., of the total deaths. It appears from Dr. Gregory (Lectures on Eruptive Fevers, p. 214) who gives a "Table " exhibiting the amount and mortality by small-pox in the well-vaccinated population " of Copenhagen, from 1824 to 1835" that of 3,839 persons attacked by small-pox no fewer than 3,093 had been vaccinated. It was these figures that led Dr. Gregory, the physician to the Small-Pox Hospital, in 1843, to declare "that some material error had " crept into the views originally entertained regarding the power and capabilities of " the vaccine inoculation. If small-pox can invade so large a proportion of a well- " vaccinated population, it is obvious, that all idea of banishing that disease from the " earth is vain and illusory."

71. The fall in small-pox death rate observed in many places in the first vicennium of this century can hardly be ascribed to vaccination. If the limited and voluntary practice of the operation could be so influential upon small-pox mortality as such a theory demands, it is strange indeed that the more complete and compulsory adoption of it should have been so uninfluential against recurring epidemics as was especially exemplified in the pandemic of 1870–74, and against more recent outbreaks in this country and abroad, in which the vaccinated figured largely among the victims. App. Vol. I., p. 74.

72. The vaccinated, nowadays, generally constitute the majority of the patients in small-pox hospitals, and in certain limited outbreaks only vaccinated persons have been attacked. 22,433.

Vol. I., App. p. 116. Thus, Mr. Marson records 3,094 cases of post-vaccinal small-pox treated by him at the Highgate Hospital between 1836 and 1851, and a further series of 10,661 such cases between the years 1852 and 1867.

1683, 1809. Dr. Gayton during the years 1870 to 1883 treated 8,234 cases of small-pox in vaccinated persons in the hospitals of the Metropolitan Asylums Board. At Sheffield in 1887–8, 5,035 vaccinated persons were attacked by small-pox. Shef. Rep., p. 191.

It is, however, superfluous to cite further evidence at this stage to prove, what is no longer denied by anybody, that small-pox attacks the vaccinated.

No witness who has appeared before us has maintained the original contention of Jenner and the earlier vaccinators, and the protection now claimed by those who assert such protection is relative, not absolute; temporary and not permanent.

73. It was at one time alleged that even if vaccination did not invariably prevent attack by small-pox, yet such attack was modified and never severe or fatal. There can, however, be no doubt that fatal small-pox and cases of the disease in all its various types of severity occur in persons who have been successfully vaccinated.

74. Dr. Gayton's tables include fatal cases, not only in those stated to be vaccinated but without visible marks, nor only in those whose marks were considered to be imperfect, but also amongst those who exhibited at the time of their attack one, two, three, and four good marks of vaccination. We are not now concerned with the question of relative mortality in the various classes, to which we shall return, but these and numerous other examples suffice to prove, what we believe is no longer disputed by anyone, that severe and fatal small-pox occurs in those who have been sucessfully vaccinated. As affecting the kind of attack, as well as liability to attack, the influence now claimed for vaccination is a relative one; that is to say, the contention is, that admitting to the full the occurrence of small-pox, and even death from small-pox in the vaccinated, yet the vaccinated are relatively to the unvaccinated in a superior position both as regards the liability to be attacked and the chance of the disease assuming a severe or fatal form. 2nd Report, App. 3, Table A.

75. Restricting our attention in the first instance to the question of liability to attack, it is right to state that in the earlier part of this century, when cases of the failure of vaccination began to multiply, it was urged that inasmuch as small-pox itself did not invariably prevent a second attack, it was unreasonable to expect that vaccination could accomplish more. This view appeared to receive support when experiments seemed to show that the cow-pox was merely the small-pox of the cow, and it was said the vaccinated are protected against small-pox because they have in fact had it. Indeed, the Select Committee of the House of Commons which inquired into the operation of the Vaccination Act in 1871 reported that they had no doubt "that "the almost universal opinion of medical science and authority, is in accordance with "Dr. Gull, when he states, that vaccination is as protective against small-pox as small-"pox itself." 1st Rep., App., p. 69.

76. We have already shown that such protection is by no means absolute, but we cannot recall a single witness who has been examined by us on this question who has not admitted that whatever may be the amount of protection afforded by vaccination, it is at any rate less than that conferred by a previous attack of small-pox.

The Registrar-General, in his 43rd Annual Report, thus states the view of "the best "authorities" on this point: he says, "it is pretty generally recognised, and this on good "grounds, that the immunity derived from vaccination is both less perfect and less "permanent than that conferred by small-pox itself; its efficacy diminishing with "the lapse of time, while the protective influence of small-pox remains practically "unaltered."

654–5. Dr. Ogle thinks there is no doubt that the protection by previous small-pox is greater than that of vaccination.

Dr. Gayton, after quoting a later opinion of Jenner's to the effect that the protection by vaccination was tantamount to that of an attack of small-pox, says, "Proofs are "abundant already, and will continue to accumulate, to disprove these statements." 1801.

Mr. Marson, in the 16 years following 1836, and when he estimated the number of persons who had been inoculated or had small-pox to be probably about equal to the number of those who had been vaccinated, found that only 47 persons were admitted to the hospital suffering from small-pox after the natural or inoculated disease, whereas there were 3,094 cases of small-pox after vaccination.

3770. Mr. Sweeting is of opinion that vaccination is decidedly less protective than a previous attack of small-pox.

At Sheffield, in the 1887–88 epidemic, Dr. Barry found, as the result of his census, that 18,292 persons, or 6·6 of the enumerated population of the borough of Sheffield, had had small-pox prior to 1887. Of these, 23 were attacked again in 1887–88, and five died. This gives an attack-rate of 13 per 10,000 against an attack-rate of 155 per 10,000 in the vaccinated. Sheffield Rep., p. 202. p. 180.

77. The evidence leads us to the conclusion recorded by Dr. Gregory, the physician to the Small-pox Hospital, in 1843, viz., "that any attempt to institute a parallel "between cases of small-pox after vaccination, and cases of secondary or recurrent "small-pox, must fail."

78. The vaccinated, therefore, stand in a position very inferior to that of those who have previously undergone small-pox *quâ* liability to an attack of small-pox. We now proceed to inquire, do the vaccinated stand in a superior position to the unvaccinated?

In other words, is the attack-rate of small-pox amongst the vaccinated less in proportion to their numbers than it is amongst the unvaccinated?

79. Various methods of arriving at an answer to this question have been attempted. A comparison has been made between the ratio of the vaccinated to the unvaccinated of those admitted to hospital with small-pox, and what is estimated to be the ratio of the vaccinated to the unvaccinated in the general population. If vaccination were an absolute protection we should, of course, find only unvaccinated patients in small-pox hospitals. If the protection were, though not absolute, yet relatively great, we should expect to find the proportion of the vaccinated patients relatively small. And in proportion as the ratio of the vaccinated to the unvaccinated in the hospital approximates to that obtaining outside (assuming the admissions to be a fair sample of the whole cases) we must regard the protection against attack of small-pox as approximating to *nil.*

80. No hospital supplies so large an experience, extending over a long series of years, as the London Small-pox Hospital. We learn from the figures recorded by Mr. Marson and Dr. Munk, and the reports of the hospital, that the per-centage of cases of vaccinated small-pox patients to the total admissions has progressively increased with the increase of vaccination among the general population, if not in exact ratio, at any rate in a ratio approximating closely to it. Munk, R. C. on S. P. Hosps., 4670.

Marson, 1871 Rep., 4190.

Years.	Post-vaccinal Small-pox per Cent. of Total.
1826	38
1835–45	44
1845–55	64
1855–65	78
1863	83
1864	84
1878–79	93
1885	93
1888–91	(14 cases only) 100

9090.

81. We are not aware of any grounds for thinking that at any time more than 90 per cent. of Londoners have been vaccinated. Judging from the vaccination returns the proportion would seem to be less than this, and the evidence derived from local investigations supports the latter view.

The per-centage of children not finally accounted for as regards vaccination in London is given as follows by the Local Government Board for the years since 1872:— Rep. for 1894–5, p. 2.

1872	8·8	1883	6·5
1873	8·7	1884	6·8
1874	8·8	1885	7·0
1875	9·3	1886	7·8
1876	6·5	1887	9·0
1877	7·1	1888	10·3
1878	7·1	1889	11·6
1879	7·8	1890	13·9
1880	7·0	1891	16·4
1881	5·7	1892	18·4
1882	6·6		

Similar figures are not obtainable prior to 1872, but there is no doubt that if they could be had they would not show less vaccinal default than do those of later years; and this would be especially true of years prior to the first Compulsory Vaccination Act of 1853.

82. These figures lend no support to the supposition that the number of vaccinated persons* in London exceeds, if indeed it reaches, 90 per cent. of the whole. We are unable, therefore, to infer from the statistics of the London Small-pox Hospital that vaccination has any very marked effect in reducing the liability to attack by small-pox, seeing that the proportion of vaccinated cases to the total has increased with the increasing proportion of the vaccinated in the population.

83. Another method of arriving at the relative liability to attack in the vaccinated and unvaccinated respectively has been by censuses taken in connexion with epidemics in particular towns. Such censuses have, as in the case of Sheffield, comprised the whole population, or as in the cases of Dewsbury, Leicester, and Warrington, been restricted to particular parts or to the infected houses.

84. The figures derived from these reports have been set out in such detail in sections 176 to 309 of our colleagues' report that it is needless to recapitulate them. We regret that owing to the reports from Dewsbury, Warrington, and Leicester having been made by medical men selected by the Commission, opportunity for examination upon them has been precluded. We shall, therefore, merely draw attention to certain points which we think require to be emphasised.

85. In the case of the Sheffield outbreak Dr. Barry has explained to us the manner in which his vaccination census, was conducted. We are unable to agree that a census conducted after an epidemic has reached its height, and after endeavours have been made to get every one vaccinated who has not already had the disease, is of much value
29,333– in determining the incidence of small-pox upon the vaccinated and unvaccinated
29,341. classes respectively. It is true that after Dr. Barry's attention had been called to this source of fallacy he made an attempt to correct the effect of it, and the figures so corrected are given in sections 232 and 234 of our colleagues' report. We doubt whether, even in the corrected figures, anything like a sufficient allowance has been
Sheffield made for the transfer from the unvaccinated to the vaccinated class before the date of
Rep., p. 161. the census. This transfer had been so great that in one district, that of Upper Hallam, only one person was found unvaccinated in the invaded houses at the time of the census, and he had had the small-pox during the epidemic. This would give an attack rate of 100 per cent. of the unvaccinated in this particular case. This is, of course, an
29,333. extreme instance, but it serves to exhibit the fallacy we are dealing with. Not only
2472. were persons at ages above those of childhood vaccinated for the first time during the
2376–2432. epidemic, but children were vaccinated at an earlier age. Indeed, the rush to be vaccinated, and the pressure brought to bear, tended to inflate the vaccinated population and to reduce the unvaccinated population to zero, or at any rate to restrict it to those of them who had survived an attack of small-pox. The result of a census thus obtained is such as one would naturally expect from assessing the cases of small-pox upon a greatly augmented population in the case of the vaccinated, and a greatly reduced population in the case of the unvaccinated. This criticism would apply even more strongly in the case of censuses of invaded households.

For these and other reasons, we think that censuses thus obtained are of little or no value in determining the incidence of small-pox on the two classes.

86. Another method of arriving at the proportion of the vaccinated to the unvaccinated in the population would be by reference to the vaccination registers. It is, however, only since 1872 that these have been compiled in their present form.

In Sheffield, we learn from Table XCVII. (p. 185 of Dr. Barry's report) that for the years 1878–87, 84 per cent. of the children born during those years were successfully vaccinated, some 10 per cent. died unvaccinated, and 4·5 per cent. remained unaccounted for. But in arriving at a conclusion as to the proportion of the whole population vaccinated on the basis of the vaccination registers, it is necessary to bear in mind that the proportion of the vaccinated amongst those born before the Vaccination Acts of 1853,
Sheffield 1867, and 1871 was in all probability very much less; thus in 1862, at an inspection
Rep., p. xv.

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* In Marylebone, one of the better vaccinated parishes of London, an examination of 2,838 children attending various schools in 1894 showed 25·6 per cent. were unvaccinated. (Sanitary Chronicles of Marylebone, August and September 1894.)

of the borough school children by an inspector of the Privy Council, 13 or 14 per cent. were found unvaccinated. It would be hazardous to assert, in view of these facts, that the proportion of the vaccinated in the whole population of Sheffield at or about the beginning of the epidemic much exceeded 90 per cent. Now of the cases of small-pox investigated by Dr. Barry in the epidemic of 1887–8, 4,151 out of 4,703, or 88 per cent., were vaccinated.

At Warrington, which like Sheffield had obeyed the vaccination laws perhaps somewhat better than the average of large towns, the per-centage of the births unaccounted for as regards vaccination given for the years 1874–89, in Table VIII. of Dr. Savill's report, varied from 1·7 in 1874 to 8·1 in 1883. Having regard to the facts we have already alluded to in the case of Sheffield, we should doubt whether the proportion of the whole population at Warrington who were vaccinated before the commencement of the epidemic in May 1892 greatly exceeded 90 per cent. Of the 667 cases of small-pox investigated by Dr. Savill, 69 were unvaccinated and 598 were included in the various vaccinated classes, or 89·7 per cent. 2103. Warrington Rep., p. 25. p. 28.

In Leicester, which in the beginning of 1893 was described by the medical officer of health as "practically an unvaccinated town," there had been in 1872 to 1875 only 2, 3, or 4 per cent. of the births unaccounted for as regards vaccination, but from 1885 onwards more than half the births were thus unaccounted for, and from 1888 to 1892 the vaccinal default amounted to from 77 to 80 per cent. of the births. Leicester Rep., p. 38.

If we assume 50 or 60 per cent. of the population of Leicester to have been vaccinated at the time of the outbreak, it is interesting to observe that of the 357 cases dealt with by Dr. Coupland, 158 were unvaccinated (including 4 "under vaccination"), and 199 (including 1 doubtful vaccination), or 55·7 per cent., were vaccinated. p. 45.

87. Dr. Coupland remarks that "the natural liability to small-pox, unaffected by "vaccination, was not so great as has been supposed." He found the attack rate much the same at different ages, despite the great variations in the proportion vaccinated according to his census:— p. 3.

—	Vaccinated, per Cent.	Attacked, per Cent.
Under 1 year - -	3·0	21·2
1 to 10 - - -	26·0	28·9
10 to 30 - - -	84·5	28·1
Above 30 - -	97·3	20·5

p. 3.

88. In Dewsbury for twenty years vaccination has been greatly neglected; from 1873 to 1876 the vaccinal default was from 22·9 to 35·3 per cent. of the births, from 1877 to 1883 the default was less, varying between 12·6 and 19·8, but for the ten years prior to the outbreak, about a third of the children born remained unvaccinated. It would scarcely be safe to assume that of the whole population in 1891 more than two-thirds, or between 60 and 70 per cent., were vaccinated. Of the 1,019 cases of small-pox dealt with by Dr. Coupland 367, or 36 per cent., were unvaccinated (including 21 "under vaccination"), and 652, or 64 per cent., were vaccinated (including 25 alleged to have been vaccinated). Dewsbury Rep., p. 10. p. 113.

89. It would appear therefore that whether as in the case of the London Small-pox Hospital we have regard to the ratio of vaccinated to unvaccinated persons attacked compared with the varying ratio of the vaccinated to unvaccinated in the population at large, or whether we consider the similar ratios in different towns where vaccination has been practised to varying degrees, we find that for the population at all ages the proportion of small-pox attacks on the two classes of vaccinated and unvaccinated respectively approximates closely to the proportion which the two classes bear to each other in the population generally.

90. Whatever influence vaccination may exert against small-pox, then, would appear to lie somewhere between none at all on the one hand, and very considerably less than that of a previous attack of small-pox on the other.

91. We have not received as yet the report of Dr. Coupland from Gloucester, but from the figures contained in section 243 of the report of our colleagues it would appear that from a census made of persons in infected houses 30 per cent. of the vaccinated were attacked, and 46 per cent. of the unvaccinated nearly all of whom were children under ten years of age.

92. The accompanying table serves to show the relative severity in regard to attack rate, mortality, and case-mortality in the various towns from which we have received special reports.

Place.	Date.	Population.	Cases.	Case-incidence per 10,000 living.	Deaths.	Mortality per 10,000 living.	Fatality per cent. of Cases.
Sheffield - - -	1887–88	316,288	6,088	*192·4*	589	*18·6*	9·7
Warrington - - -	1892–93	54,084	667	*123·3*	62	*11·4*	9·3
Dewsbury - - -	1891–92	162,596	1,029	*63·2*	110	*6·7*	10·7
Leicester - - -	1892–93	184,547	357	*19·3*	21	*1·1*	5·8

The above table shows that Leicester and Dewsbury in which vaccination had been much neglected came off better as regards both attack rate and mortality than did Sheffield and Warrington in which vaccination had been well carried out. And further, while in Leicester, where only 55 per cent. of the cases of small-pox were in vaccinated persons, the fatality was 5·8 per cent.; in Sheffield and Warrington, where more than 80 per cent. of the cases of small-pox were in vaccinated persons, the fatality was 9 per cent. The fact that only 22 or 25 per cent. of the deaths occurred in children under ten is but small compensation to Sheffield and Warrington for their high attack rate and mortality rate.

93. When we proceed to inquire whether vaccination exerts an influence upon the character of an attack of small-pox so as to render it milder or less fatal than it would otherwise have been, our investigation becomes more difficult. If the influence of vaccination on small-pox be only or chiefly that of mitigating the severity of an attack of that disease, rather than the prevention thereof, an important argument for insisting upon the practice on public grounds is neutralised. It is asserted that mild natural small-pox is or may be as infectious as the severer forms, and indeed it is often found that outbreaks of the disease have been traced to infection from unrecognised small-pox in vaccinated persons, the disease being, it is said, so modified in its features by vaccination. If this be so, vaccination may well be a matter for personal choice, as an agency calculated to ameliorate individual cases of the disease, but, if it exert little or no influence against attack by small-pox, it cannot be insisted on as a means of reducing danger to the public by way of infection.

94. Analogy does not here render us much assistance; there is so far as we are aware no evidence to show that in the case of other infectious diseases, attacks of which are held to confer immunity towards subsequent attacks, such second attacks should they occur are milder than the first. Indeed, there is evidence pointing in the opposite direction.

95. Are we then to institute a comparison between the case-mortality or fatality of small-pox last century and the present? Or between times and places where vaccination has been neglected and those wherein it has been well carried out? Or shall we find an answer to the question in the comparison of the fatality in the vaccinated and unvaccinated respectively in recent outbreaks? If we make the last comparison, are we able to sort the two classes accurately, and is vaccination the only material point of distinction between the two classes?

96. We have received a great deal of evidence directed to all these points. Broadly speaking, while there has always been considerable variation in the fatality of the disease at different times and in different places, from about 1 in 3 (33 per cent.) to about 1 in 40 (2·5 per cent.), the fatality on a large number of cases averages about 7057. 8336–7. 1 in 7 or 8 (14·3 or 12·5 per cent.). This was the average fatality of natural small-pox generally accepted last century, and used by Bernouilli for his calculations in 1760, as stated in section 53 of our colleagues' report.

Vol. III., App. 3, p. 201. 24,802.

Jurin's figures, based upon a large number of cases collected by him during the first half of last century, give a fatality from natural small-pox of 16·5 per cent. of those attacked. We agree with our colleagues that the criticism made upon Jurin's figures, to the effect that deaths under two years of age were excluded, fails to establish the alleged fact.

Rep. for 1894.

97. The fatality observed on a total of 60,855 cases of small-pox in the hospitals of the Metropolitan Asylums Board from 1870 to 1894 was 16·7 per cent. This rate includes vaccinated and unvaccinated without distinction. It is important to point out that caution must be observed in comparing the fatality in hospital with cases treated at

home, and also in comparing hospital fatality regard must be had to whether all cases are admitted to hospital or only the more severe. Thus in recent years in London, when the great majority of small-pox cases are at once removed to hospital, the fatality has been as low as 7 or 8 per cent., while in earlier years, when the Asylums Board's hospitals were less generally resorted to and the accommodation limited, the fatality was as high as 20 or 21 per cent.

98. In order to obtain a large aggregate we may add together the London and the provincial figures :—

—	Cases.	Deaths.
London (1870–94) -	60,855	10,183
Sheffield - - -	6,088	589
Dewsbury - -	1,029	110
Warrington - -	667	62
Leicester - - -	357	21

Here we have a total of 68,996 cases with 10,965 deaths, or a fatality of 15·8 per cent.

99. The broad result is that when large figures are taken the fatality of small-pox now, with a large majority of the cases protected by vaccination, is about the same as it was last century, when none of the cases had received any protective rite.

100. It is true that when the cases of small-pox in various epidemics in this country and abroad have been sorted into groups according to whether the patients have been vaccinated or not, the result is almost invariably to show a higher rate of fatality in the unvaccinated than in the vaccinated class. The range of difference is considerable. Fatalities in the vaccinated from 1 per cent. to 18 per cent., but rarely higher, are recorded. Unvaccinated fatalities of 9, 13, 30, and 50 per cent., and even higher, are recorded. Table N., App., vol. 2, pp. 240 and 236. In some sets of figures the unvaccinated fatality rate is three, four, and five times that of the vaccinated; 6814. in others, such as the Berlin and Duisburg figures for 1871–72, the rates at various ages are not very different in the two classes.

101. It has been argued that the difference of the case-mortality in the two classes is not due, or not wholly due, to the presence or absence of vaccination, and further that the division into the two classes is not properly made. Vol. VI., App. 14, p. 720.

It is alleged that the unvaccinated differ qualitatively as well as quantitatively from the vaccinated. Thus, this class, it is urged, includes (1) infants under the age of vaccination; (2) those whose vaccination is postponed on account of poor health in obedience to the instruction to public vaccinators to vaccinate only those who are healthy; and (3) those 8713. of the lowest and most neglected social class. Inasmuch as these, when they constitute a considerable proportion of the whole unvaccinated class, would, from reasons apart from vaccination, raise the case mortality, it is urged that the high fatality of the unvaccinated must not be ascribed merely to the fact of their non-vaccination.

Objection has also been made to the classification by marks on the skin of cases of a 8709. disease whose chief symptom is, and the chief cause of whose fatality is, the abundance of an eruption on the skin. It is claimed that the fact of vaccination or non-vaccination of small-pox patients should be determined by reference to the vaccination registers, not by the visibility of marks on the arm.

Reference has been made to some of these objections in our colleagues' report, but we hardly think sufficient weight has been attached to them. It is clear that if these objections are well founded, some part of the difference between the fatality of the vaccinated and the unvaccinated is explicable without reference to vaccination. It is difficult to say whether the whole difference can be thus explained.

102. There can be no doubt that in towns where vaccination has been well carried out a considerable proportion of the unvaccinated population consists of young infants. Thus at Warrington it was found by Dr. Savill that of 57 unvaccinated children living Warrington Rep., pp. 35, 39, 49, 54. in the invaded houses, 22 were under one year, of these 13 were one month or under, and of these eight were attacked, and all of them died; these eight babies constituted one-third of the total unvaccinated deaths. The inclusion of such cases in the unvaccinated class raises the unvaccinated case mortality, while the vaccinated class is necessarily free from a similar contingent of young infants.

103. A certain number of children are every year reported as having had their vaccination postponed by medical certificate on account of ill-health; thus, in the year 1892, 13,278 were so reported in England and Wales. It is possible some of the ailments necessitating postponement may not have been very serious, but this again constitutes a sub-class of the unvaccinated class which has no counterpart among the vaccinated, and may have an influence on the case mortality. It is obvious that the importance of the presence of these two classes of the very young and the postponed among the unvaccinated becomes greater in proportion to the strictness with which the Vaccination Acts are enforced. In towns where the Acts are thoroughly carried out the unvaccinated class should consist almost exclusively of these two sub-classes, in whom it is urged a high fatality rate is to be naturally anticipated. It is certainly curious to note that while the unvaccinated fatality rate is given as 49·6 per cent. at Sheffield and 35·3 per cent. at Warrington, at both of which vaccination has been thoroughly enforced; at Leicester, where the unvaccinated class was much larger and very differently composed, the unvaccinated fatality is recorded as 12·0 per cent. The mere fact of non-vaccination is evidently insufficient to explain this remarkable difference.

1842–3.

104. Dr. Gayton thinks the unvaccinated patients he treated were drawn from a poorer class than the vaccinated, and that this circumstance would tend to make the fatality among them higher than in the vaccinated. It would appear that, except in towns where the Acts are not administered, a not inconsiderable proportion of the unvaccinated is contributed by waifs and strays and paupers. Dr. Stevens, in giving evidence before the Hospitals Commission of 1882 (Q. 3434), thus explained the prevalence of small-pox in London. He said there were three very distinct classes of people who helped to keep up small-pox in London. "First of all from a very large class, viz., "immigrants; and those immigrants I calculate to the extent of two-thirds, are "workhouse-born people. I estimate, of course very roughly, there are about 10,000 "children born every year in workhouses and lying-in institutions, and hitherto they "have universally escaped vaccination, because once out of the workhouse unvaccinated "it is impossible to get at them, no one knows of them, and having lost their birth "record they wander about, and to a large extent get up to London and get small-"pox. Then just imagine the numbers of years that these unvaccinated workhouse "children have been accumulating." That among such persons, apart from vaccination, a high fatality rate should obtain is at least probable. We know that Dr. Murchison, from the figures he collected at the London Fever Hospital, found that social class as well as age had an influence on the case-mortality of typhus fever. He found:—

In paying patients a fatality of - - - 14·89 per cent.
,, free non-pauper ,, ,, - - - 18·58 ,,
,, parish paupers ,, ,, - - - 27·64 ,,

The influence of social class upon case mortality of infectious diseases is also brought out by comparing the statistics of the London Fever Hospital, which now only admits paying or non-pauper patients, with those of the Metropolitan Asylums Board hospitals, which admit pauper and non-paying patients.

CASE-MORTALITY IN 1889 FROM

Hopwood, Lords' Com. 1891, 21,675–21,682. Ann. Rep., M.A.B., p. 18.

——	Scarlet Fever.	Typhoid.	Diphtheria.
London Fever Hospital - -	1·2	5·2	17·6
Metropolitan Asylums Board hospitals	8·85	15·15	40·74

We think it probable that social class has an influence upon small-pox fatality in the same direction.

30,826–37. 1816–20. 30,832–47.

105. Three main varieties of small-pox are recognised—the discrete, the confluent, and the malignant. The first is rarely fatal even in the unvaccinated; the last is almost always fatal even in the vaccinated. It is the confluent variety that mainly dominates the case mortality of the whole. Now it is in the confluent variety that question is most likely to arise as to whether marks of vaccination are present or not. If seen early, before the eruption is complete, no difficulty may be encountered, but in cases not seen until a later stage, in which the eruption is abundant and the liability to a fatal issue great, difficulty has undoubtedly occurred. It is in these worst cases that in the opinion of Dr. Birdwood, there is risk of including vaccinated cases in the

unvaccinated category. Indeed, so alive to the difficulty of classification by marks is 31,230.
Dr. Birdwood, that, after an experience of 12,000 cases of small-pox, he is of opinion 31,061.
that "the evidence of primary vaccination collected in small-pox hospitals should not
" be relied on. Because—

"(1.) On the outbreak of an epidemic there is necessarily much administrative confusion, and many untrained observers. The early observations are incomplete and faulty.

"(2.) In the worst instances the eruption may be sufficient to, and does, obscure the scars. 31,221.

"(3.) The statement of parents as to primary vaccination, and of adult patients as to re-vaccination, should be accepted even when scars are not seen.

"(4.) Scars produced in infancy grow with the growth of the body, as was pointed out, I understand, by Sir James Paget.

"(5.) In such statistics insufficient allowance is made for other circumstances, such as occupation, intemperance, and the existence of other diseases. An altogether different death-rate might be anticipated if small-pox broke out in a public school, or in the infirm and aged wards of a workhouse. A typhoid fever patient, or an ill-fed baby, catching discrete small-pox and dying, would be counted a death from small-pox, obviously neither vaccination nor its neglect having anything to do with it.

"(6.) The accurate observation and record of clinical details is one of the most difficult duties required of medical men employed in hospitals for infectious disease."

106. We could have wished, in view of the doubt cast upon the classification of 28,461.
small-pox patients into vaccinated and unvaccinated, that resort had been oftener had 2330.
to the vaccination registers for corroboration or correction. 2359.

We note that Dr. Savill was alive to the difficulties to which we have alluded; in his 28,480. 28,714.
report on the Warrington outbreak, he says:—" In nearly all fatal cases the eruption 31,250.
" is profuse and tends to hide the vaccination scars if they exist. Hence the doctor's 28,468.
" or nurse's evidence 'unvaccinated' if based solely on their own observation is less 16,147.
" valuable than the doctor's statement 'vaccinated.' Such was probably the source 16,621.
" of error which arose in Case 473. If the pocks are very plentiful, or are situated Warrington
" over the vaccination scars, or when the congestion and induration of the skin, so Rep., p. 34.
" characteristic of severe small-pox, is present in large amount, then the plainest of
" scars, and certainly a faint one, is liable to be described as absent."

He also cites an instance in which reference to the vaccination register sufficed to
rectify an important error:—" Cases 79 and 75. The brothers Peter and James
" L——, æt. 20 and 8 respectively, are very good illustrations of the difficulties which
" often beset an inquiry as to vaccination in fatal cases. For a long while I was
" assured on good authority that they were both unvaccinated persons. I was told
" that no record could be traced of their vaccination, and no marks could be seen
" during life. The death certificate, of which I procured a copy, contained the word *Ibid.*
" 'unvaccinated' in both cases. Both mother and father of these lads were dead, and
" those members of the family available could give me no definite information. I
" therefore included them, at first, in the unvaccinated class. But some time later I
" succeeded in finding an older brother, who stated in general terms that he was sure
" all his brothers and sisters had been vaccinated except little Walter, another child
" who contracted the disease and recovered (Case 80). This statement was confirmed
" by his uncle Sam and an old friend of his mother's. Next I sought an old friend
" and servant of the family, who said she always 'thought Peter was vaccinated; but
" 'as to Jimmy I used to see his marks thro' washin' 'im so often; he had two good
" ''uns.' Finally, I determined to search the vaccination register myself and found
" that against the name of Peter L——, who was born on May 26th, 1872, the
" vaccination entries were vacant, but against the name of James L——, who was been
" on April 12, 1884, was an entry of successful vaccination on August 22nd, 1884."

107. Dr. Savill also calls attention to the fact that vaccination scars tend to become obliterated with age, and to alter in character with time.

108. In earlier statistics, and in many of Dr. Luff's tables in regard to small-pox in M.A.B. Rep.
London, only two classes appear, viz., those vaccinated and those unvaccinated, for 1893.
apparently no evidence as to vaccination being accepted except the presence or absence
of scars on the arms. Dr. Ricketts, of the Small-pox Hospital Ships, calls especial
attention to this class in his report for the year 1893, showing that "an absolute
" reliance ought not to be placed on this evidence. There is no doubt that cases occur

"in which vaccination has been successfully performed, although cicatrices are not
p. 136. "present when the attack of small-pox supervenes. There is a small class, too, but
"naturally a very fatal class, in which the rash is too abundant over the upper part of
"the arm for an assertion to be made that scars are absent." Dr. Ricketts truly
observes that "in considering the vaccination statistics of small-pox cases, it is clear
p. 138. "that in comparing the vaccinated with the unvaccinated class, it would never do to
"leave out of consideration these doubtful cases among which the fatality is so high,
"a class which includes nearly a quarter of the total deaths."

109. Attempts have been made to classify cases of small-pox according to their
p. 136. severity as well as according to their fatality. This classification is open to the obvious
objection that "no two men could, independently, classify the same series of cases in the
"same way." When a further division of the severe and mild cases into vaccinated
and unvaccinated is made, another source of error is introduced by reason of the
inconclusiveness of the evidence as to vaccination.

110. When we consider all the sources of error to which we have alluded we are led to conclude that the difference in fatality between the vaccinated and unvaccinated small-pox patients is not as great as is sometimes contended, and that so far as it exists it cannot be due merely to the effect of vaccination, while the fact that the fatality of all cases lumped together is practically the same now as it was in the unvaccinated of last century, when large numbers are taken for comparison, strongly suggests that the inclusion of a large contingent of vaccinated persons has not exerted a mitigating effect on the average fatality of the whole.

111. In view of the fact now recognised, that whatever protection vaccination affords against small-pox is temporary and relative, not permanent and absolute, various attempts have been made to determine what is the shortest period within which an attack of small-pox can occur after vaccination. We have shown that the variolous test, or the inoculation of the vaccinated, was largely given up after the first few years of this century, Jenner and Bryce advocating the re-insertion of vaccine lymph as a test of equal efficacy. The records of attempts at producing small-pox by inoculation at various periods after vaccination are, therefore, not very numerous. We shall allude to some of those which have been laid before us. Evidence is also available on the point in question as the result of inquiries which have been made as to the date of vaccination and the onset of subsequent small-pox in various epidemics. Lastly, we have the results of re-vaccination at different intervals of time from primary vaccination.

95,472–8. 112. Goldson, of Portsea, in 1804 published cases of the inoculated and the natural
disease occurring within two or three years of vaccination. In 1809 Brown, of Mussel-
burgh, published his "Inquiry into the Anti-variolous Power of Vaccination," in which
11,852. he recorded 48 cases of children who had caught small-pox within three, four, five, six,
seven, eight, nine, and ten years of their vaccination. He relates also how he had aban-
doned inoculation since the year 1800, having been satisfied with the negative results he
obtained in those whom he had tested a few weeks or months after their vaccination.
The occurrence of small-pox in vaccinated children led Brown to apply the variolous
test to some vaccinated children at a longer interval of time; he then found that after
the lapse of from three to six years vaccination no longer rendered the variolous test
ineffectual, and he was forced to the conviction "that vaccination even in the most
"perfect form is not only incapable of imparting permanent security against small-
11,855. "pox, but even of retaining the system in that state of impregnation capable of only
25,479. "allowing it to exercise its influence to a safe or trifling extent." It is a matter of
25,517–21. regret that the writings of Brown and Goldson were not received with the attention
and courtesy from their contemporaries that they deserved. Had they been then fairly
considered much misapprehension and misrepresentation might have been avoided.

113. A relatively low fatality rate in vaccinated children under ten is, as is shown in the report, a remarkable feature in recent epidemics, and this, if it were constant, might well be urged as a ground for encouraging the practice of infant vaccination when small-pox is prevalent, if no other means for controlling the disease were available. This, however, is not the case, and we believe that, if the measures of prompt detection and isolation we advise were universally and energetically adopted, there would be no excuse for allowing small-pox to run riot or to invade the settled population, and least of all to attack young children.

Sheffield 114. We find that at Sheffield in 1887–8 there were according to the census 353 cases
Rep., p. 178. of small-pox in vaccinated children under ten years of age, of whom 121 were under
29,381–2. five, of whom 11 were under one. In children vaccinated by public vaccinators
29,388. we find cases of severe small-pox at six years, three years, two years, and under one

year; the first two were fatal. There is a case of very slight small-pox at six months 29,391-2.
and one 14 days after vaccination. 29,415.

It is usual to exclude cases at a less interval than a fortnight after vaccination from 29,409.
the vaccinated category, on the ground that the vaccination had not at that period 29,411.
exercised its influence on the constitution, although the "success" of vaccination is 19,814-5.
registered on the eighth day after the operation; there are plenty of instances in this 28,708.
and other outbreaks, of the two diseases running their courses together in the same
person.

At Dewsbury in 1891–2 there were 44 case of small-pox in vaccinated children under Dewsbury
ten years of age, of whom 17 were under five. Rep., p. 114.

At Warrington in 1892-3 there were 33 cases of small-pox in vaccinated children Warrington
under 10 years of age, of which two were confluent attacks and terminated fatally. Rep., pp. 51 and 54.

In London in 1892-3 there were 110 cases of small-pox in vaccinated children
under ten, 27 of which were under five, and of these seven were under one. London Rep., pp. 6 and 16.

Dr. Browning, medical officer of health for Rotherhithe, writing in 1892, called
attention to the fact that children and adults recently vaccinated with humanised lymph, 8429.
and some showing good marks, worthy of an extra grant from the Government 12,386(note).
inspector, yet took small-pox within a few days, months, or years of their vaccination.
He cited 25 cases of small-pox in vaccinated children under ten of whom three died.

Dr. Gayton in London between 1870 and 1884 saw 1,306 case of small-pox in children Vol. I.,
under 10 stated to have been vaccinated, of these 137 died, 303 of these cases were App., p. 245.
between the ages of two and five with 56 deaths, 58 were under two with 12 deaths.

Dr. Gayton accordingly thinks that "primary vaccination is a very fleeting 1755.
"protection indeed," and that it is not absolutely protective up to any age whatever. 1768.

115. It has been argued that, inasmuch as cow-pox is to be regarded as the small-pox 173.
of the cow, and as vaccination is to place the vaccinated in the same position as if they
had been through an attack of small-pox, the repetition of the operation is to be held 177.
to be the equivalent of the old variolous test. That consequently as long as re- 1837-9.
vaccination is successful, it indicates that the person so successfully re-vaccinated had re-acquired susceptibility to small-pox. If this view be correct it would be strange indeed that, while vaccination was unable to protect an individual against the repeated operation of its own poison, it was yet capable of protecting against the operation of the more potent poison of small-pox.

116. The difficulty of this position was early realised by Dr. Pearson and the directors of the Vaccine Pock Institution; in their report for the year 1803 (p. 49) they declared that persons who had undergone vaccination could not undergo it a second time, and that persons who had undergone small-pox could not be infected with the cow-pox. These views are strangely out of harmony with the experience and practice of to-day.

117. If we accept, with Jenner and Bryce, the theory that re-vaccination is a test of susceptibility to small-pox "of equal efficacy" with variolous inoculation, we then have a means whereby we may gauge the duration of the temporary protection or antagonism conferred by vaccination.

118. The earliest experience of re-vaccination on an extensive scale is recorded by Vol. I., App.,
Heim in the Wirtemberg army in 1829. Out of more than 14,000 soldiers who were p. 47.
re-vaccinated about 60 per cent. exhibited perfect or modified success. Another series gave a perfect success in more than 50 per cent. of the re-vaccinations. Moreover, a perfect result was obtained not less frequently in those who presented normal cicatrices than in those in whom the scars of primary vaccination were defective; and again there was no marked difference in the success of vaccination on those soldiers who bore marks of small-pox from that which attended the re-vaccination of those who did not.

119. The experience derived in recent years from our own army is similar. The table Vol. II., App.
put in by Brigade-Surgeon Nash shows that in nearly half of the re-vaccinations of 8, p. 277.
soldiers and recruits perfect vaccinal pustules are obtained; in about a fourth of the whole a modified success occurs; while in the remainder the operation gives a negative result.

Higher per-centages of success are recorded by continental observers, 70, 80, and even 11,606.
90 per cent. being mentioned in the case of military re-vaccinations. In the case of school children in Germany at the age of 13 or 14 the success rate is 70 to 82 per cent.

120. M. Layet, of Bordeaux, has recorded the results of a large number of re-vaccinations 11,607–
of school children at different ages, with calf lymph. Putting aside the 11,649.
partial or modified results, described by him as *fausse vaccine*, he found that in 41 to 11,619.
45 per cent. of the whole number at all ages he obtained perfect vaccine vesicles. 11,626.
Moreover, his success-rate was about the same in children of six years old as it was in Vol. IV.,
those over 13. The exclusion of the modified successes or "*fausse vaccine*" from App. 1,
Layet's figures makes his success-rate appear lower than that of other observers, who p. 407-8.

included all degrees of success. The striking feature about Layet's figures is that vaccinated children of six show as great a susceptibility, or, as it is argued, as much unprotectedness against small-pox, as do those of 13.

121. Similar experience is afforded by the results of re-vaccination of the children of soldiers in this country. The success-rate is greater and the failures fewer in the case of the re-vaccination of children than in that of soldiers or recruits. Inasmuch as the latter are further removed from their primary vaccination, want of success of re-vaccination can hardly be ascribed to the abiding influence of the first operation. Indeed the fact that the success-rate in the re-vaccination of children approximates nearly to that of their primary vaccinations, while the *primary* vaccination of recruits and soldiers is less successful than that of children, strongly suggests that the failure or modified success of re-vaccination in adults is due not to the abiding influence of a primary vaccination, but to other changes the result of age. Vol. II., App. 8, p. 277.

122. The results of vaccinations and re-vaccinations in the army formed the subject of an interesting paper by Professor F. Smith, of the Army Veterinary School, communicated to the Sanitary Institute in 1892, and entitled "For how long does vaccination "confer immunity against small-pox?" He noted that the per-centage of successful vaccinations was 92·64 per cent., of successful re-vaccinations 88·37 per cent. Of the 79,591 re-vaccinations, 15,842 had a modified success, and 54,497 had perfect vesicles. In the latter "the vesicles are as perfectly defined as in a primary vaccination. It is "important to bear this fact in mind, for no matter what view we take of the modified "vesicle, I think there can be no doubt that a person who developes a perfect vesicle "is one who would have contracted small-pox if exposed to the contagion. On "examining the 5,832 primary vaccinations it is found that 92·64 per cent. were "successful; these vaccinations were only 4¼ per cent. better than the re-vaccinations. "In what way are we to interpret these results? It is certain that of 79,591 "persons only 11·63 per cent. (adopting vaccination as a test) were protected against "small-pox, and this number may be further reduced when we consider that many of "the failures were due to other causes than protection, for of the primary vaccinations "7·36 per cent. failed. If, therefore, we take these figures as representing the failures "due to inert lymph, &c., it leaves only 4·27 per cent. of the adults as protected "against small-pox by their previous vaccinations." Trans: of Sanitary Institute, Vol. xiii., pp. 116–8.

Professor Smith further states that within three years of a thorough re-vaccination it is possible for a person to be successfully re-vaccinated, the result produced being naturally of a modified character. He adds: "I can, however, go a step further than "this, and affirm that, after a successful primary vaccination, it is possible to successfully re-vaccinate a person 12 months later, the only difference between the first and "second vaccinations being that the latter will run a more rapid course, though, "excepting for this fact, the character of the vesicle produced is nearly indistinguishable "from a primary inoculation."

4540–4552. 123. If vaccine is to be regarded as attenuated variola, we are not aware of any ground for anticipating that after immunity towards the weaker virus has ceased, immunity towards the stronger virus should continue.

124. That even severe small-pox does not prevent the success of subsequent vaccination is shown by the experience of Dr. Scroggie, of Aberdeen, quoted by Mr. Skelton:—

28,029–30. "Although a second attack of small-pox is very uncommon, I re-vaccinated 15 cases "who had had the disease, some of them severely, as indicated by the deep and "numerous pittings left, and in 13 found them susceptible to the vaccine virus. The "disease is usually fatal at the extremes of life, so I have vaccinated from the infant "of a few weeks to the adults from 80 to 90 years of age. The re-vaccinations done "were 356 in number, and of these 339 were successful."

125. It would appear from the foregoing facts that while shortly after vaccination there may be a certain amount of immunity or antagonism to the influence of renewed vaccination, or inoculation with small-pox, and therefore, it may be argued, to the natural disease, this soon wears off, perhaps more rapidly in some than in others. It would seem that in the majority of cases susceptibility to re-vaccination is encountered in a few years, though tests at shorter intervals do not appear to have been extensively made. The evidence suggests that insusceptibility towards inoculation is not more lasting; while cases of natural small-pox are recorded at all possible intervals subsequent to vaccination.

126. Attention is called in section 293 of our colleagues' report to the results of some 20,000 cases of small-pox when classified according to the number of marks they exhibited. It must be borne in mind that these cases must be regarded as 20,000 failures of the protective properties of vaccination as originally proclaimed, and that it would not be very remarkable if, speaking generally, it were to be found that in classifying cases of a disease whose fatality is mainly due to the amount of eruption,

those cases would on the whole show a higher recovery rate in whom a greater number of scars could be clearly discerned on the skin of the arm.

127. In regard to the manner and degree in which the number and quality of the vaccination cicatrices exert an influence over the liability to or the severity of subsequent small-pox, we have received a good deal of conflicting evidence. It has been argued
that if the virus of the vaccine disease be of a self-multiplying character, one insertion 846.
should, as was originally held, be as efficacious as many; and that the nature of the 11,593.
cicatrix being due largely to local causes, or individual peculiarities, this can indicate 11,642.
nothing as to the constitutional effect which the virus has produced. On the other hand, a large collection of statistics, such as those of Marson and others, has been adduced to prove that the mitigating effect of vaccination varies with the number of cicatrices, and that the area and foveation of the scars affect the fatality of subsequent small-pox.

128. There are some points in regard to the late Mr. Marson's statistics which it would have been well to have elucidated further, but it has not appeared possible to do so. We
refer especially to his method of deducting deaths due to superadded disease, and to his 224, 301.
mode of dealing with cases in which abundance of the eruption obscured the cicatrices, 841.
cases which occasioned considerable difficulty in classification to his predecessor, 30,832–4.
Dr. Gregory, and to many later observers. There is a good deal of evidence, especially 31,221. 31,230.
from France, showing that neither the number nor the quality of primary cicatrices 31,235.
exerts any influence upon the success of re-vaccination; indeed, it is noted by some 11,618.
observers that re-vaccination is more likely to take in those in whom the scars of primary 11,642.
vaccination are large and well-marked. Moreover, it would appear that in the practice
of the most experienced vaccinators, and with the same lymph of the best quality, the 4706–11.
cicatrices vary immensely; some are plain, some puckered, some foveated, indeed, one
French observer has figured some 70 varieties of scar resulting from vaccination. 11,892,
This would tend to show that differences of constitution, age, the mode of performing
the operation, the extent of the local inflammation, &c., have an important bearing on 11,893.
the qualities of the resulting scars.

129. We are also struck with the different methods adopted by different observers in
classifying cases of small-pox according to the vaccination marks. Thus Dr. Gayton, 1700–1706.
who collected 10,403 cases, informed us that when he found one good mark and three imperfect marks, he might class them as a case of two good marks, or he would ignore the three imperfect marks and class the case as one of a single good mark.

Dr. Gayton, among his 10,403 cases of small-pox admitted to hospitals of the Metropolitan Asylums Board between the years 1870 and 1884, found 2,085, or 20 per cent.
of the whole number, to be what he calls "vaccinated with good marks," while Mr. Vol. 2, p.245,
Sweeting, at another of the Board's hospitals in the years 1880–85, out of 2,584 cases App.
only placed 39, or 1·5 per cent., in the category of "good vaccination." It is evident 3689.
that such a difference indicates a wide margin for personal discrimination as to what is and what is not "good vaccination."

At Dewsbury, Dr. Coupland reports that while small-pox proved fatal in ten cases Dewsbury,
out of 175 with two marks, no death occurred among the 34 cases with only one mark; Rep., p. 115.
and again, while one death occurred among the 42 persons with four or more marks, all the 210 with three marks recovered.

Dr. Luff's figures for London show a higher fatality among those with two marks
than in those with one mark; in the former it was 3·4 per cent., and in the latter Vol. 1, App.,
2·7 per cent. In Marson's figures the one mark cases were accorded a fatality of 13·8 p. 116.
per cent. in 1852–67.

Dr. Savill does not classify the Warrington cases according to marks, but he gives Warrington
cases and illustrations to show that small-pox is sometimes more severe in those Rep., p. 42.
members of a family who present first class or typically perfect scars than in those who show indifferent evidence of vaccination. Such cases, he was subsequently led to think, were exceptional.

Mr. Sweeting's figures seem to show that age has an important bearing upon any
influence the number of the vaccination marks may exert. Thus over 30 years of age 3717.
he found that the fatality was—

With 1 mark,	124 cases	with 19 deaths, or	15·32 per cent.
,, 2 marks,	149	,, 20 ,,	13·42 ,,
,, 3 ,,	105	,, 16 ,,	15·23 ,,
,, 4 ,,	50	,, 7 ,,	14·00 ,,
,, 5 or more	27	,, 4 ,,	14·81 ,,

So that it would appear that after 30 years of age the number of the scars is a matter of indifference as regards fatality of small-pox.

130. We cannot, in view of the diversity of classification adopted, and the abundant sources of error to which such basis of division is inherently liable, attach any great

importance to statistics dealing with the number of the cicatrices. As to quality, it seems that the character of scars is largely dependent on conditions other than the nature of the lymph employed, and any relationship between quality of scar and succeeding small-pox may be the result of such conditions and not of the influence of the lymph inoculated.

131. There has been a change in the age-incidence of fatal small-pox; small-pox has been less a disease of childhood than it used to be. Statistics collected last century, and especially during the inoculation period, when small-pox was almost endemic, seem to show that a large proportion of all children suffered from it, and the deaths from the disease were mostly those of children. Records of the 17th century suggest that the disease at that time was less prevalent and affected adults as well as children. It has been pointed out that "the whole question of the age incidence of fatal small-pox depends on
25,743. " the frequency of the epidemics. If an epidemic comes once in 20 years you will not " have the same proportion of deaths under five years as you have in a place where it " comes in a period of less than five years. It all depends upon that; and there is no " possibility of getting any general law from isolated places."

132. While it seems to be true that last century in towns and places where, through absence of any precaution against spread, or by promiscuous inoculation, small-pox was kept endemic, the bulk of the small-pox deaths were of persons under ten years of age, this does not appear to have been uniformly the case in the country or in places where the disease was only introduced at long intervals.

24,802. 133. Thus in a most careful account of an outbreak of small-pox in the little parish of Aynho, in Northamptonshire, in 1723–4, preserved in the Royal Society's Library, it is stated that of 132 cases of the disease only 28 were under ten, and of the 25 deaths only four, or 16 per cent., were under ten. In many records from different towns the large proportion of the total deaths from small-pox which occurred in children is brought out, some 80 per cent. of the whole being under five.

134. During the present century, and especially since 1870, the larger incidence of fatal small-pox on adults has attracted attention. There have been considerable differences in different places and in different epidemics. Thus in Paris in 1842–51 it was observed that 66 per cent. of the total small-pox deaths occurred in persons above the age of 5, while in London at about the same time only 32 per cent. of the whole were above that age. It is obvious that various causes, *e.g.*, the ages of the exposed population and other local considerations, must be borne in mind in arriving at any conclusion as to the cause of the observed phenomena. Thus, small-pox if it spread in a school would necessarily fall upon a different age class from what it would if it spread in a factory or barracks. 1st Report, App., p. 76.

135. In sections 171–192 the change of age-incidence has been fully treated in special relation to changes in the law and in regard to vaccination; in this relation it is therefore unnecessary to labour the point further.

136. It is important to bear in mind that the change we are discussing is not merely a change of distribution of a fairly constant or diminishing number of small-pox deaths as between infants and adults, but that there has actually been in proportion to the population at each age during certain years an increasing death-rate of adults from small-pox, notwithstanding the increasing use of vaccination and re-vaccination.

137. Thus in the table contained in the 43rd Report of the Registrar-General for England it is shown that if a comparison be instituted between the small-pox death-rate at different ages during the period 1872–80 (when vaccination was as efficiently enforced as it ever has been) with the period 1847–53 (when the practice was voluntary) we find that at every age over 10 years the chance of dying of small-pox was greater in the period of compulsory vaccination.

MEAN ANNUAL DEATHS IN ENGLAND AND WALES AT DIFFERENT AGES PER MILLION LIVING AT EACH SUCH LIFE PERIOD.

——	0–	5–	10–	15–	25–	45 and upwards.
1847–53. Voluntary vaccination - -	1,617	337	94	109	66	22
1872–80. Compulsory vaccination - -	323	186	98	173	141	58

These figures are so serious that they have been urged by Dr. Bridges as sufficient ground for a revision of the law; he thinks that if these facts had been generally known at the time the Legislature would have hesitated as to the compulsory law. 30,871.

138. The London figures are not less remarkable:—

ANNUAL SMALL-POX DEATH RATES PER 100,000 AT DIFFERENT AGES IN LONDON.

Thorne, 1st Report, p. 118.

—	0–5 Years.	5 Years and upwards.
1851–60 - - -	130	13
1861–70 - - -	116	14
1871–80 - - -	113	34
1881–88 - - -	37	16

Thus we see that, except in the last period (which has been one of increasing default in regard to vaccination), and then only in the case of those under five years of age, there has been no substantial reduction of small-pox mortality, while at all ages over five the mortality from small-pox has been actually greater in the last three periods than in the first. Such saving of life as there has been in London in the period 1851–88 was most noticeable in the period 1881–88, and was confined to children under five years of age.

139. It has been urged that the observed changes in age incidence of small-pox mortality point to vaccination rather than sanitary reforms as the cause of the difference, since sanitary reforms should operate equally upon all ages, while vaccination might be expected to affect especially the young. There are, however, some considerations which prevent the acceptance of this explanation, at any rate for the whole of the facts. The increased death-rate from small-pox in persons above the age of childhood might with equal reason be ascribed to vaccination, or at least seems incompatible with the belief that the influence of vaccination against fatal small-pox is of an abiding character. Moreover, it has been pointed out by the Registrar-General in his report for the year 1879 that sanitation operates differently upon the general mortality of persons at different age periods. He calls attention to the fact that "while the mortality in early life has been very notably diminished, the mortality "of persons in middle or advanced life has been steadily rising for a long period "of years." He adds, "That the sanitary efforts made of late years should have "more distinctly affected the mortality of the young is only what might be naturally "anticipated; for it is against noxious influences to which the young are more "especially sensitive that the weapons of sanitary reformers have been chiefly "directed." He further suggests that the enhanced mortality at later ages may in part be due to the indirect influence of sanitation by preserving from early death a vast number of children of permanently unsound constitution who so diminish the healthiness and add to the death-rates of later ages. At any rate there is evidence to disprove the assertion that sanitation in the wider sense must affect mortality at all ages equally. 363. 516.

140. Again, it has been fairly urged that, in order to ascertain whether the shifting of the age incidence of fatal small-pox can be fairly attributed to vaccination rather than to sanitary reforms, it is desirable to institute a comparison between small-pox deaths or death-rates at different ages and other comparable diseases rather than with the deaths or death-rates from *all* diseases.

141. Dr. Ogle thinks that the zymotic diseases would be the better ones to compare small-pox with, but he truly observes: "It is impossible to make similar comparisons "in the case of scarlet fever or measles, and diseases that only affect children. Fever "is the only one of the zymotic headings that you can take, because it is the only one "that affects all ages to any extent. Fever is, therefore, the only which it is possible "to subject to this kind of investigation." 516. 518.

142. Now in regard to Typhus, which is not at the present time responsible for many deaths under five years of age, we learn that, comparing the earliest quinquennium which the Registrar-General's figures enable us to use with the quinquennium 1886–90, a fall of 46·9 per cent. in the children's share, *i.e.*, from 6·4 per

cent. to 3·4 per cent. For the same period in the case of Typhoid fever (even when the necessary correction for varying classification in regard to remittent fever has been made) there is a fall of 51·7 per cent. in the children's share, *i.e.*, from 17·4 per cent. to 8·4 per cent. For small-pox (even without any correction for chicken-pox) there is a fall during the same period of the children's share equal to 36·9 per cent., *i.e.*, from 31·1 per cent. to 19·6 per cent.

Not only then do we find that in certain other zymotic diseases comparable with small-pox a shifting of age incidence of the deaths so that the children's share is less and the adults' share greater than was formerly the case, but the shifting would appear to be somewhat greater in the case of Typhus and Typhoid fevers than in the case of small-pox.

143. The diminution of mortality of infants side by side with increase of mortality of older persons, which has been claimed to specially indicate the influence of vaccination upon small-pox mortality, seems to be also true in a remarkable manner of influenza.

The Registrar-General in his Fifty-fourth Report institutes a comparison between the great influenza epidemics of 1847–48 and 1890–91, and calls attention to the fact that "the epidemic of 1890–91 was distinguished from the equally fatal epidemic of " 1847–48 by the greater comparative severity with which it attacked persons of " middle age," and the table he gives shows that, while at ages under 15 there was a lower rate in the last epidemic, at ages from 15 to 55 there was an enhanced mortality, while above 65 there was again a reduction.

144. We find in these facts evidence that in diseases other than small-pox, and against which no artificial protective is invoked, there has been a change in the age-incidence of deaths and death-rates in the same direction as, and not very dissimilar in amount from, that which has been asserted to be distinctive of small-pox in consequence of the special influence of vaccination upon it. We are bound to conclude that a theory of causation which takes no account of these phenomena is unequal to an adequate explanation of the whole case.

145. If we are right in our conclusion that causes other than vaccination are operative upon the age-incidence of fatal small-pox, and if, as we hold, sanitary measures are influential upon small-pox mortality, and if it be true that "it is against noxious " influences to which the young are especially sensitive that the weapons of sanitary " reformers have been chiefly directed," we should naturally expect to find that in sanitary or healthy districts as compared with less sanitary or unhealthy districts the reduction of small-pox mortality would be greater among the young than among the adult population.

146. That this is actually the case has been shown in section 198 of our colleagues' report. It is true that the admitted fact is there referred to the greater opportunity afforded to town dwellers of catching small-pox and catching it early. We are, however, quite unable to agree with our colleagues that overcrowding upon area or within dwellings ought not to be regarded as an insanitary circumstance, and the fact remains that sanitation or environment, or at any rate means other than vaccination, exert a profound influence, not only upon the amount of small-pox mortality, but also upon its age distribution.

147. That vaccination cannot be accepted as an adequate explanation of the shifting of age incidence of fatal small-pox, or at any rate as the sole explanation of the phenomenon, is proved by the fact that a very considerable shifting has been observed in the case of deaths from small-pox of those certified to have been unvaccinated. Now it is only since the year 1881 that the Registrar-General has classified the deaths from small-pox into three groups, the vaccinated, the unvaccinated, and the " not " stated." Confining our attention to the unvaccinated, we learn that of 3,746 deaths in the years 1881-93, 1,483 were under five years of age, or 39·5 per cent. Now it has been repeatedly stated that the normal proportion of deaths from small-pox under five to the total small-pox deaths last century (and vaccination apart) may be taken as 80 per cent. What then is the explanation of the reduction of the proportion by one half? It has indeed been alleged that vaccination may indirectly have produced the effect by reducing the amount of small-pox or controlling its virulence. If this explanation be regarded as satisfactory, it may equally be urged that any measures such as isolation and more efficient precautions against contagion may also exert a powerful influence, not only upon the amount of small-pox, but also upon its age distribution amongst the unvaccinated.

Vol. 1, App., p. 76.

973–8.

148. In this connexion it is not without interest to note the varying distribution of fatal small-pox according to age in the epidemic year 1871 in different districts of Scotland:—

——	Total Deaths.	Deaths under Five.	Deaths under Five, per Cent. of Total.
Principal towns (with population above 25,000) - - -	886	195	22·0
Large towns (with population from 10,000 to 25,000) - -	143	32	22·3
Small towns (with population from 2,000 to 10,000) - -	209	55	26·3
Mainland rural districts - - - - - - -	183	25	13·6
Insular rural districts - - - - - - -	11	0	0·0

816–9.

Public Health Repts., No. IV., p. 67.

In Dundee the highest proportionate infantile mortality of all was observed, the *Ibid.* p. 71.
per-centage under five being 28.

We are not aware of any statistics pointing to the more thorough vaccination of the 26,867–
populations in the rural and island districts; indeed there is reason for thinking that 26,875.
default is more common in those parts than in the towns; there is, however, evidence 6th Report,
indicating that the greater healthiness of the country districts shows itself in the smaller App., p. 654.
proportion of the total deaths which occurs under five years.

We learn from the City Chamberlain of Glasgow (Vital, Social, and Economic Statistics of Glasgow, 1891) that while in Glasgow, in 1875–79, 45·02 per cent. of the total deaths from all causes were under five, and in the small towns 35·59 per cent., in the mainland rural districts the proportion was 26·77 and in the insular rural districts 19·90. We think it not improbable that the age distribution of deaths from such a disease as small-pox and the mortality from it at different ages may be largely governed by the extent to which, by precautions against contagion and by sanitary surroundings the disease is kept within bounds and prevented from securing foothold upon the settled population. Where the contrary conditions prevailed and the spread of the disease was permitted and promoted, as in London and other large towns last century, the preponderant proportionate mortality of children was what we should naturally expect.

149. The claim that a second vaccination or re-vaccination places a person in better position as regards attack or death from small-pox is based largely on the experience derived from re-vaccination of soldiers, and of nurses and attendants whose duties bring them into close relation to the disease.

It will be seen from the reports made to us that re-vaccination is by no means an absolute protection. At Warrington, of 64 re-vaccinated persons living in houses invaded by small-pox, eight were attacked, giving an attack rate of 12·5 per cent.

In London, of 108 cases of small-pox in re-vaccinated persons, seven were severe, and four, or 3·7 **per cent.**, fatal, a fatality-rate higher than in the once vaccinated class.

150. The army, in obedience to numerous orders, has been very thoroughly re-vacci- 345.
nated, and, in the opinion of Brigade-Surgeon Nash, "it is as perfect as endeavours can 3559.
"make it," and, indeed, he was unable to suggest any means whereby it could be made 3560.
more thorough than it is. From the table he put in we learn that from 1860 to 1888
inclusive there were 3,953 cases of small-pox and 391 deaths in the army, giving a case
mortality of 9·9 per cent. Considerable variation is to be observed in the attack rate,
and the mortality in the re-vaccinated soldiers according to where they are stationed.
Thus, in the year 1888, the attack rate among troops in the United Kingdom was one
per 10,000, in the Colonies 3, in India 15, in Egypt 42, and the death rates were per Vol. II.,
10,000 in the United Kingdom ·1, in the Colonies 0, in India 1·4, and in Egypt 11·9. App. 8,
The explanation of these differences is to be found in the difference of the degree of p. 278.
exposure to contagion in different places. Thus in Cairo and Assouan in 1889 an 3551.
excessive amount of small-pox among the troops was traced to this cause. There were
42 cases and six deaths, giving an attack rate of 12·2 per 1,000, and a death rate of
1·75 per 1,000, rates as high as those for the whole population of Warrington during
the epidemic.

The Army Medical Report for the year states:—

"A detachment of the 1st Battalion Welsh Regiment was stationed at Assouan "during the latter part of 1888 and the early part of 1889; during that time an out- "break of small-pox occurred among the native population, and the disease broke out "among the troops; two cases also occurred on the voyage from Assouan to Cairo.

"Notwithstanding all the precautions taken in Cairo, and due regard having been paid "to vaccination and re-vaccination, the disease kept on the increase, and in the month "of May presented signs of doing so still further. The Welsh Regiment, which "suffered most, was in Kasr-el-Nil Barracks, which are situated near a crowded "thoroughfare and on the banks of a navigable river. It being more than probable "that the disease was derived from natives, the Welsh Regiment, on the recommenda-"tion of the principal medical officer, was removed to Abbassiyeh, where the situation "is healthier and intercourse with the natives could be prevented. Small-pox, the "principal medical officer, Deputy-Surgeon-General Jameson, remarks, is always more "or less prevalent among the natives in Cairo, and indeed throughout Egypt, and as "there exists no means of segregating affected cases it is certain that patients in various "stages of the disease are permitted to walk about, and to frequent the bazaars and "streets to the great danger of the public."

After these precautions were adopted there appears to have been a considerable reduction in the amount of small-pox among the troops in Egypt.

In the report of the Army Medical Department for 1888, speaking of small-pox mortality in Bengal, it is stated, "The greatest number of cases occurred at Lucknow, "32 with five deaths; it is stated that all the men had been re-vaccinated, and the "cases varied from being very mild to severe and confluent."

151. The evidence in regard to the re-vaccination of nurses has been fully dealt with 1,392. in sections 313–329 of the report. They seem to enjoy a greater immunity from small- 22,211–22,222. pox than re-vaccinated soldiers; and instances are on record showing that attendants who have not been re-vaccinated have also enjoyed an immunity which has been 31,013. remarkable. The table given in section 329 of the report compares the liability of 6th Rep., App., p. 687. taking three infections with the liability of taking one. Cases of small-pox have been instanced in attendants and nurses who have been re-vaccinated; in such cases it is generally noted that the re-vaccination was not successful. While some hold that an unsuccessful re-vaccination is of no account, others, in accordance with the teaching of 1837–1839. 4734–5. Jenner and Bryce, regard it as indicative of insusceptibility and assert that as long as a person is liable to successful vaccination he is liable to take small-pox; and that, therefore, insusceptibility to re-vaccination indicates protection.

152. When we consider the large number of attacks and deaths by small-pox which have occurred amongst our thoroughly re-vaccinated army on foreign service, the attack rate of re-vaccinated persons living in houses invaded by small-pox at Warrington and Dewsbury, as well as the number and fatality of re-vaccinated persons attacked by small-pox in London, we are forced to the conclusion that the remarkable immunity recorded in the case of nurses in small-pox hospitals cannot be wholly accounted for by the fact that they have been re-vaccinated. In the hospital at Bicêtre during the siege of Paris, in the midst of a larger accumulation of small-pox patients than has ever been known before or since, the immunity of those attendants and doctors who had neglected re-vaccination was even more marked than in the case of the orderlies, who were nearly all re-vaccinated. We attach considerable importance to the narrative given by M. Colin of 12,389–95. his experience as Chief Medical Officer to the Bicêtre Hospital during the siege. The point of his narrative is that while 15 of the re-vaccinated or well-protected hospital orderlies took the disease, not one of the 80 who composed the medical and nursing staff, so many of whom had neglected re-vaccination, was attacked. He says ("La Variole," 1873, p. 114): "Nous avons démontré, en deuxième lieu, que le personel "hospitalier de Bicêtre a été peu éprouvé par la variole, dont il ne se manifesta aucune "atteinte parmi les quarante médecins et pharmaciens attachés a l'établissement, ni "parmi les quarante religieuses qui soignaient nos malades nuit et jour, et qui habitaient "le centre de l'hôpital; grand nombre de ces personnes cependant n'avaient point "voulu céder aux conseils que je leur donnais de se faire revacciner." It is sufficiently clear that M. Colin, though an impassioned advocate of vaccination, was so struck by the complete immunity of the medical and nursing staff, who by their neglect of re-vaccination appeared to offer less guarantees of protection than the orderlies, nearly all of whom had been re-vaccinated under his own eyes, that he thought it necessary to attempt an explanation.

153. The theory he expounds is not original, it has been broached by other authorities, and is applicable to some other contagious diseases. M. Colin (pages 39 and 90) suggests that a certain tolerance is acquired by repeated exposure to contagion, and that in those who are not at once attacked the receptivity to the disease becomes exhausted. The theory may or may not be true, but it has often been observed that in cases in which nurses have taken small-pox from their patients it has been at such interval of time, usually about a fortnight after exposure, as would suggest that those who are very susceptible take the disease at once, and it is possible that, as M. Colin suggests,

those who do not thus fall ill acquire the immunity which repeated exposure tends to Homerton
give. Dr. Gayton has called attention to the fact that many "nurses and servants, Report,
"persons well vaccinated, suffered from sore throat and headache on their first 1875.
"exposure to small-pox contagion. It is reasonable to believe that their illness was
"the result of small-pox poison," but he doubts whether it would be correct to say
that they had small-pox. Vaccination, especially if with matter of variolous origin,
may, when performed at such a time prior to exposure as to pre-occupy the system,
operate in the same direction.

154. With a view to prove the truth of the theory that cow-pox is the small-pox of
the cow—variolæ vaccinæ—and also to establish fresh lymph supplies, numerous
attempts have been made by several observers in various ways to infect bovine animals 168.
with the virus of human small-pox. In the majority of the experiments the results
have been negative. In a few, when the small-pox matter has been diligently 169.
rubbed into scarifications, or denuded surfaces, or punctures, certain results have been
obtained which have been variously interpreted. The positive results have generally 12,283.
been redness, tumidity, or papules at the points of insertion. In some of the successful
cases, appearances approaching what may be described as vesicular have been obtained,
a few, indeed, have exhibited the physical appearances of vaccine inoculated on the
calf; such vaccine results have sometimes appeared not at the points of insertion but
at some distance from them. In none of the experiments have the usual signs of
natural cow-pox been found to result.

155. Some of the cases in which vesicular results were obtained are certainly open to 5129.
the objection that under the circumstances under which the experiments were made, 24,091.
there was the possibility, and even the probability, that vaccine virus (accidently communicated)
accounted for these results.

156. Matter obtained from the local products of such variolations of animals, when 171–2.
inoculated on human beings, in the hands of Chauveau and others, gave rise to small-pox,
which proved to be infectious. In the hands of others, matter taken from the 12,292.
local results, even when these bore no resemblance to vaccine vesicles, after serial
inoculations on animals and human beings, approximated so closely to the vesicles of
ordinary vaccination as to be indistinguishable from them; in such cases there does not
appear to be any ground for believing that the communicated disease, whatever its
nature, is any longer infectious.

157. In order to obtain local results on human beings similar to those of ordinary
vaccination, by the application of matter derived from human small-pox, it does not
appear necessary to resort to the cow as an intermediary. One of the earliest experimenters
who succeeded in variolating the cow, Dr. Thiele, of Kasan, described a Vol. 1, App.,
method of storage and dilution of small-pox virus, whereby he was enabled to cultivate p. 68 (note).
lymph giving results indistinguishable from vaccine. Dr. Walker, who carried on a
large vaccination practice in London, in the beginning of the century, appears to have
entertained similar views, and practised the dilution with water of the small-pox
virus.—(Memoirs of Lettsom, Vol. iii., p. 351.)

158. Adams, in 1805, had already succeeded in obtaining perfect vaccine results, without
rash, with small-pox lymph taken from a mild variety of that disease. Guillou, in
1826, again records the fact that all the local appearances of vaccination could be
obtained with lymph of undoubted variolous origin. Indeed, results approximating 4895.
to these appear to have been arrived at by some inoculators in the previous century,
who claimed to give small-pox without fever or eruption, and with no other symptoms
than those occurring on the inoculated arm; it was, however, pointed out that such 24,891–
modified variolation did not give the same immunity as that which usually occasioned an 24,907.
eruption.*

159. While it is probable then that the insertion of small-pox matter into the skin of a calf can produce vesicles similar in some cases to those obtained by the inoculation of cow-pox matter, we are not aware of any evidence to show that the inoculation of the pox of the cow on the human skin has ever produced small-pox. In this sense then cow-pox and small-pox are not convertible, and we think it is incorrect to speak of cow-pox as the small-pox of the cow.

160. Moreover, there is a considerable amount of evidence showing that morbid fluids 12,295.
derived from other and apparently distinct diseases can when inoculated give rise 12,174–
to vesicles like those of vaccine, not only in the cow but in the human subject. The 12,233.
virus of cattle plague, of horse grease and horse-pox, of sheep small-pox, and of 11,594–11,604.
syphilis, and it has been alleged the application of tartar emetic, have given rise to 11540–5.
vesicles when intentionally or accidentally inoculated which differ from vaccine vesicles 21,975.
less than these differ amongst themselves. Matter obtained from some of these sources, 11,484–7.
27,142.
8894–8900.

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* Cf. Mudge, Dissertation on Inoculated Small-pox, p. 20; Bromfield on Inoculation, p. 44; Adams, A Popular View of Vaccine Inoculation, 1807.

other than cow-pox, has been at various times used to start fresh strains of lymph for vaccination. If from such varied sources vaccine results can be obtained, it by no means follows that because from human small-pox a vaccine vesicle can under certain circumstances be raised, there is, therefore, any special or essential inter-relation between cow-pox and small-pox.

161. Various more or less speculative views have been advanced to account for the ascertained facts in regard to immunity towards disease, whether natural or acquired. It has, indeed, been suggested that acquired immunity is in some way connected with
12,414. the chemical results upon the tissues of the febrile process by whatever means
12,236. 24,181-3. occasioned. This subject needs fuller investigation, but there is some evidence which at
25,995. least suggests that diseases held to be specifically distinct may exert some kind of
4619-4622. temporary antagonism towards one another.*

162. Though small-pox and cow-pox still occur in many parts of the country, such outbreaks do not appear to be in any way associated as cause and effect, though special attention has been directed towards the discovery of such relationship. We therefore conceive the correct view to be, that among the various morbid fluids whose inoculation into the calf's skin can produce a "vaccine" result, small-pox matter is one, but this fact no more implies the identity of cow-pox and small-pox than does a similar result from the inoculation of other viruses imply the identity of either small-pox or cow-pox with the diseases furnishing such viruses.

163. The question very naturally arises whether, seeing that lymph from various sources has been from time to time set going, there is any difference to be observed between the various stocks in their influence upon subsequent small-pox. Unfortunately it is no longer possible to distinguish between the various stocks now in circulation. Neither is it possible, in view of the law against inoculation, to submit the present or fresh stocks to the variolous test. It has been plausibly conjectured that vaccine lymph of variolous origin, such as Woodville's, or that of Ceely and Badcock, and of other experimenters in the variolation of cows, may be of superior efficacy to that derived from cow-pox, horse-grease, cattle plague, &c.

164. It is by no means clear that lymph from sporadic cases of cow-pox obtained from time to time has been derived from the true cow-pox of Jenner as distinguished from those varieties which have been termed "spurious." We know that Jenner attached the greatest importance to such discrimination. Spontaneous cow-pox, which produced no erysipelas, and showed no phagedenic disposition, he regarded as spurious. "This disease," he said, "is not to be considered as similar in any respect to that of
" which I am treating, as it is incapable of producing any specific effects on the
" human constitution. However, it is of the greatest consequence to point it out here,
" lest the want of discrimination should occasion an idea of security from the infection
" of the small-pox, which might prove delusive."

165. It was the cow-pox derived from the greasy heel of the horse that gave the true cow-pox, according to Jenner; matter from the horse direct, he found, did not impart immunity towards small-pox.

In a later publication, he stated that he "found that some of those *who seemed to*
" *have undergone the cow-pox*, nevertheless, on inoculation with the small-pox, felt
" its influence just the same as if no disease had been communicated to them by
" the cow. This occurrence led me to inquire among the medical practitioners in
" the country around me, who all agreed in this sentiment, that the cow-pox was
" not to be relied upon as a certain preventive of the small-pox. This for a while
" damped, but did not extinguish my ardour; for as I proceeded I had the satisfaction
" to learn that the cow was subject to some varieties of spontaneous eruptions upon
" her teats; that they were all capable of communicating sores to the hands of the
" milkers, and that whatever sore was derived from this animal was called in the
" dairy the cow-pox. Thus, I surmounted a great obstacle, and in consequence was
" led to form a distinction between these diseases, one of which only I have denomi-
" nated the *true*, the others the *spurious* cow-pox, as they possess no specific power
" over the constitution."

166. Investigations carried out under the medical department of the Local Government Board, and especially by Dr. Klein, have served to show the number and variety of the diseases of the teats and udders of cows, and the difficulty of accurately discriminating between them. In reporting on some of these diseases in 1887,
27,125. Dr. Klein observed:—
L. G. B. M. O. Rep. 1888-89 and 1887-8. "In view of this second differentiation of a definite disease from among the mass of
" cow diseases that show sores on the teats, the old division into true and spurious
" cow-pox has become manifestly insufficient. It is seen that the name 'spurious cow-

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* Jenner employed vaccination to render dogs immune against distemper, and De Carro claimed it as antidotal to the virus of the plague.

"pock' has in all probability been used to cover a variety of sores, having essential "differences in nature, just as until the time of Jenner the name 'cow-pock' had "covered along with various other things the disease which we know as vaccinia. But "it is one thing to have learnt the essential nature of those sores in the cow that are "concerned with vaccinia or scarlatina in the human subject; and another thing to "affirm the distinguishing characters by which those sores may be recognised from "other sores that once on a time laid claim to being equally with them 'cow-pox' or "'spurious cow-pox.' Our new discontent with the name 'spurious cow-pox' does not "at once give us a knowledge of the nature of those sores which remain on the list; "and we are now learning that there are many different kinds of such sores."

167. It is evident that the diagnosis of the various diseases which have been 27,129–27,132. collectively termed cow-pox is no easy matter; and it is to say the least doubtful whether the many new stocks which have been put in circulation have been all of the same species. It is certain that several stocks have been derived from so-called "spontaneous" cowpox, as for instance that of Laforet, from which the National 4278–9. Vaccine Establishment was supplied, when the calf lymph station was inaugurated.

168. We regret that in the course of our inquiry we have not obtained from the experts who have favoured us with their views any satisfactory definition of "vaccination." No definition of the term appears in any of the Vaccination Acts. Our late and much regretted colleague, Mr. Bradlaugh, we know attached great importance to this point.

169. Mr. Ceely, so far as we are aware, was the last in this country to apply the variolous test to a new stock of lymph. He thus tested 21 persons who had been 12,303–4. inoculated at periods varying from 5 to 31 months previously with his matter got by variolating the cow. In every case some effect resulted; in nearly all papulo-vesicular elevations or "mother-pustules" appeared at the insertions. In a few there was slight Vol. IV., App. 1, p. 412. fever which, in one case, proved to be infectious, and in one child with four fine scars, the result of the inoculation five months previously, there was an eruption of hard warty papules over the whole body, several of which suppurated. These experiments were held to prove that a certain amount of immunity had been conferred by the previous inoculation, although no control experiment was made to show the effect of the matter inoculated in the same way upon unprotected persons.

170. It is impossible now to distinguish the various stocks of vaccine in use, it is, however, clear that much of that now current in this country and abroad is not derived from cow-pox at all, and probably still less is derived from that special variety of cow-pox which Jenner regarded as the true or protective variety. It is scarcely probable, unless indeed it be held that all viruses that will give rise to the physical appearances of a vaccine vesicle when inoculated, are identical, that one and all should be endowed with precisely the same effects *quâ* immunity towards small-pox. If we had to express a preference for lymph derived from any of the sources described we should give it to that of variolous origin, provided always it has been rendered incapable of giving rise to infection.

171. In section 361 of our colleagues' report, an analogy is suggested between vaccination against small-pox and Pasteur's protective inoculations of animals with attenuated viruses to protect them against certain epizootics.

We have already given our reasons for doubting the assertion that the cow-pox is the small-pox of the cow, and it should be remembered that M. Pasteur, in borrowing the term "vaccination" to describe his inoculations, was careful to point out that the difference is great in some respects between the two classes of facts. (*Lancet*, November 6, 1880.) If, however, the view which regards vaccination as analogous to the Pasteur inoculations be correct, it may be of interest to follow out the analogy into practice.

172. The chief diseases of flocks in which protective inoculations have been tried on a large scale are anthrax and pleuro-pneumonia.

173. Experience, however, seems to prove that the protective inoculation of anthrax, Board of Agriculture, Rep. under C. D. Animals Acts for 1894. 10,984. while it gives rise to a certain amount of immunity for an indefinite period towards subsequent "experimental" inoculation with the virulent material, leaves the "vaccinated" animals still liable to infection in the natural way. Experiments in this country, in France and in Germany have not confirmed M. Pasteur's original contentions. The tendency of modern opinion and practice appears to be rather in the direction of the adoption of the "stamping-out system" by the pole-axe, destruction of infected carcases, and disinfection rather than of reliance upon the "stamping-in" system of protective inoculations. In the last report of the chief veterinary officer of the Board of Agriculture, we read that "Dr. Klein's reports appear in the Report of the Medical 26,007–26,014. "Officer of the Local Government Board for the years 1881–82, but the results which "followed his investigations were in direct conflict with the statement made by

"M. Pasteur, since all the sheep vaccinated by Dr. Klein either died as a result of the injection of the vaccine material, or succumbed to anthrax when inoculated with the virulent material, after being what was considered immune to the disease."

Ibid. It is further stated in a report by Professor Muller, of the Royal Veterinary School of Berlin, that "preventive inoculation of anthrax has not many, I may even say no, friends in Germany," and that "preventive inoculation was practised from 1882 till 1885 or 1886 in the provinces Saxony and Posen by four or five great landowners or farmers who have suffered great losses every year by enzootic anthrax, and were induced to try inoculation by the apparent good results gained in Parkisch. The virus was obtained in all cases directly from Paris. In the beginning these inoculations were repeated every year, but little by little they were discontinued. I believe that preventive inoculation is now fully abandoned in Prussia, and has not been practised during the last five or six years."

On the other hand we learn from Professor Muller that "the general opinion of scientific authorities in Germany is that the best measures against anthrax are a careful destruction of carcases, and a most careful disinfection, and that inoculation will have no effect in lessening the loss caused by this disease."

174. In regard to pleuro-pneumonia, the experience seems to be very similar and to point to the conclusion that, while the "stamping-out" system of slaughter and disinfection appears to be adequate to the eradication of the disease altogether, such result cannot be obtained by protective inoculations.

The report of the Departmental Committee of 1888 on pleuro-pneumonia is to the effect that protective inoculation "cannot be depended on as an efficient means of exterminating pleuro-pneumonia." The Committee attached especial importance to the experience of the rival methods in the Netherlands. They stated :—

"We have, with your Lordship's approval, and the sanction of Her Majesty's Treasury, summoned before us M. Lameris, one of the Government veterinary surgeons, residing at the Hague. In view of the fact that Holland is the only country in the world from which, after having obtained a good foothold, pleuro-pneumonia has been eradicated, the evidence of this gentleman possesses considerable interest and importance."

"From the evidence of M. Lameris it appeared that for many years inoculation was practised by owners of cattle, and so impressed were they by the benefits which appeared to result from that operation, that they petitioned the Government to make the inoculation of cattle in Holland universal and compulsory. The Ministers, however, declined to accede to this request, not only on the ground of expense, but because of the difficulties attendant on the carrying out of such a law, and of obtaining sufficient inoculating material."

"In 1871 an order was issued for the compulsory slaughter of all actually diseased animals, compensation being paid out of the Royal funds. After three years, compulsory inoculation of suspected cattle was also employed, though not universally. These combined methods of treatment, however, although reducing the disease, failed to eradicate it, and therefore the system of stamping out was adopted, and since 1885 the Netherlands have been practically free from pleuro-pneumonia."

"M. Lameris was very decided in his opinion that compulsory vaccination could not have cleared his country of disease; that stamping out was the safest and most certain way of attaining this result, and proved, in the long run, to be the cheapest."

10,969. 175. In the case of sheep small-pox, which more closely resembles the small-pox of man than does any disease of the lower animals, and in which accordingly it was hoped, and declared by Sacco and others, that protection might be artificially secured, Dr. Seaton stated the accepted view when he said "no fact is more conclusively established than the utter worthlessness of vaccination for saving sheep from small-pox." (Handbook of Vaccination, p. 42.)

25,927–25,983. 176. Attention has recently been directed to protective inoculations against cholera, with more or less successful results; but while such protection may be a matter for individual choice, the sanitary vigilance carried out under public authority seems to have been strikingly successful in preventing the disease from spreading in this country.

Reference III.—The objections made to Vaccination on the ground of injurious effects alleged to result therefrom.

Simon, 1857, Papers, p. lxvii. 177. It was at one time officially maintained that against "the vast gain" by vaccination there is no loss to count. Of the various alleged drawbacks to such great advantages the present state of medical knowledge recognises no single trace."

Vol. I., App., p. 93. The Select Committee of 1871 reported "that if the operation be performed with due regard to the health of the person vaccinated, and with proper precautions in obtaining and using the vaccine lymph, there need be no apprehension that vaccina-

“ tion will injure health or communicate any disease.” Even more recently this view has been re-affirmed in a pamphlet, entitled, Facts concerning vaccination for heads of families, “ revised by the Local Government Board, and issued with their sanction,” which states that “ as to the alleged injury from vaccination, all competent authorities
“ are agreed that, with due care in the performance of the operation, *no risk of any* 21,853.
“ *injurious effects* from it need be feared.” 1871 Committee, 3210.

We agree with our colleagues that, notwithstanding repeated and emphatic assertions to the contrary, the admission must without hesitation be made that risk attaches to the operation of vaccination.

178. The statements contained in sections 399–421 of the Report appear to us to give ample reason at least for hesitation in retaining compulsory vaccination in any form. We allude especially to the following statements, in which we generally concur :—

Section 399.—“ It is not open to doubt that there have been cases in which injury
“ and death have resulted from vaccination.”

Section 409.—“ It must not be forgotten that the introduction into the system of
“ even a mild virus, however carefully performed, is necessarily attended by the
“ production of local inflammation and of febrile illness.”

Section 410.—“ It is established that lymph contains organisms, and may contain
“ those which, under certain circumstances, would be productive of erysipelas.”

In section 413 we are told that vaccination may become exceptionally risky, through special circumstances over which, in our opinion, the parents can have little or no control, such as the prevalence of disease in the neighbourhood.

Section 417.—“ It may, indeed, easily be the fact that vaccination, in common with
“ chicken-pox, measles, small-pox, and other specific fevers, does occasionally serve as
“ an exciting cause of a scrofulous outbreak.”

Section 418.—“ It is freely to be admitted that vaccinia, like varicella, does occa-
“ sionally cause an irritable condition of skin which may last long, but it is exceedingly
“ improbable that it is responsible for any substantial increase in the number of chronic
“ skin diseases in children.” And again, “ Amongst the inconveniences connected with
“ vaccination is the production of contagious forms of eruption, such as have been
“ classed under the names of porrigo and impetigo contagiosa. These eruptions are
“ not attended with any risk to life, nor by any permanent injury to health, and they
“ are usually curable by simple measures. References to these eruptions have been
“ made by many witnesses. Their occurrence has no doubt not unfrequently caused 22,876–
“ prejudice to the practice of vaccination.” And in section 419 is recited the case of 22,903.
“ a child previously in good health, and vaccinated with calf lymph by means of a 23,029.
“ needle which had never been used before, who died about six weeks afterwards with 23,064–23,067.
“ severely ulcerated arms, and ulcers in several parts of the body and limbs. No
“ precaution had been neglected, and the event could only, as in other similar cases,
“ be attributed to what is known as idiosyncrasy on the part of the child, a peculiarity
“ of health attended by exceptional susceptibility to the specific virus of vaccinia.”

In sections 420 and 421 it is pointed out that “ It was at one time doubted whether
“ syphilis could result (from vaccination), and it was even confidently asserted that
“ it could not,” but that “ Facts which were, not long after the issue of Mr. Simon's
“ report, brought before the profession, and which were carefully investigated, made it
“ certain that the negative conclusion which had been arrived at was a mistaken one,
“ and from that time no doubt can have been entertained by any that it is possible to
“ convey syphilis in the act of vaccination.”

179. Putting together all these admitted elements of danger, though each may be slight in itself, we think that the sum of them constitutes a very serious objection even to the modified form of compulsion favoured by our colleagues.

180. It appears to us that the case for even this modified compulsion is practically surrendered in section 437, where our colleagues insist on the right of parental option as to the lymph to be used, on the ground that the risk of syphilis from arm-to-arm vaccination, however slight, is “ naturally regarded by a parent with abhorrence.” We cannot understand on what principle a parent is entitled to refuse arm-to-arm vaccination, because he regards its risks with abhorrence, but is not entitled also to refuse the not unreal risks of calf lymph, though he also regards these with abhorrence.

181. We are not prepared to attach much weight to figures put in by Dr. Ogle, insti- 27,197.
tuting a comparison between Leicester and the whole of England and Wales in regard to the changes in the infantile mortality from various diseases. To make such com-
parison valuable it would be, as Dr. Ogle seemed inclined to admit, better to compare an 27,199–204.
urban population similar to that of Leicester, but in which vaccination was thoroughly carried out. If we want to ascertain by the method of differences whether vaccination exerts a detrimental effect by increasing the mortality from certain infantile diseases,

it is surely imperative to see that the places or times compared differ as little as possible in respect of circumstances other than vaccination.

Vol. IV., App. 3. 182. In the statistics which Mr. Biggs furnished we do not find any evidence that the increasing disuse of infantile vaccination in Leicester has prejudicially affected the mortality of young children; on the contrary, there has not only been a marked reduction of the general death rate since 1875 but a reduction in the death rate of infants under one year, a rate which reached its highest point since 1838 in the period 1868–72, when vaccination was most thoroughly enforced.

183. We must remember that though machinery exists for registering the success of vaccination, there is no system for notification of untoward results, or any means other than the certificates for obtaining official information of the total number of deaths directly or indirectly due to vaccination. In Scotland there appears to be even less provision for inquiry into alleged ill-results than is the case in England. 3887. 28,016–38,021.

184. Our colleagues hold that though some of the dangers said to attend vaccination are undoubtedly real and not inconsiderable in gross amount, they are relatively few in proportion to the amount of vaccination that is done. They suggest an analogy with railway accidents, as an example of a risk that is every day disregarded. They quote the figures given by Dr. Ogle as showing one death to 14,159 primary vaccinations. We give reasons for thinking the number of deaths under-estimated, but accepting the ratio as correct, it is interesting to compare it with that of the number of railway passengers killed to the total number of passengers. Sect. 434. Sect. 379. Sect. 403. 6th Report, p. 647.

Accidents on Railways, Board of Trade Report, 1894.

Year.	Number of Passengers Killed from causes beyond their own control, from Accidents to Trains in the United Kingdom.	Number of Passenger Journeys (exclusive of Journeys by Season-ticket Holders).	Proportion returned as Killed (from causes beyond their own control) to Number carried.
1881	23	622,160,000	1 in 27,050,435
1882	18	654,838,295	1 in 36,379,905
1883	11	683,718,137	1 in 62,156,194
1884	31	694,991,860	1 in 22,419,092
1885	6	697,213,031	1 in 116,202,171
1886	8	725,584,390	1 in 90,698,049
1887	25	733,670,000	1 in 29,346,800
1888	11	742,499,164	1 in 67,530,000
1889	88*	775,183,073	1 in 8,808,875
1890	18	817,744,046	1 in 45,430,224
1891	5	845,463,668	1 in 169,092,733
1892	21	864,435,388	1 in 41,163,589
1893	17	873,177,052	1 in 51,363,356
1894	16	911,412,926	1 in 56,963,307

* Including 80 killed and 262 injured in collision near Armagh.
Number of season-tickets issued in 1894, 1,185,000.

ENGLAND and WALES: DEATHS ascribed to VACCINATION, 1881–91.

Year.	Number of Deaths.	Primary Vaccinations.
1881 - - -	58	766,179
1882 - - -	65	764,518
1883 - - -	55	763,092
1884 - - -	53	766,338
1885 - - -	52	758,992
1886 - - -	45	755,337
1887 - - -	45	735,536
1888 - - -	45	720,991
1889 - - -	58	708,919
1881–89 - - -	476*	6,739,902*
1890 - - -	43	(Not yet published.)
1891 - - -	43	(Not yet published.)

* One death to 14,159 primary vaccinations.

We cannot help thinking that if railway statistics showed one death to 14,159 passengers, a railway journey would be a much more anxious affair than it is at present.

Appendix. 185. We are deeply impressed with the sad cases of severe illness and suffering and death which the investigations of medical men appointed by the Commission have, after rigid scrutiny, failed to disconnect from vaccination. We are also struck with the fact that under the circumstances which must obtain in the houses of the poor, additional risks to health and life are encountered, and that the operation cannot be regarded as free from even the more avoidable risks, except under conditions and precautions it is perfectly impossible to secure. To compel vaccination under such circumstances, even if its value were greater than it is, is in our opinion morally indefensible. It is with a sense of shame and amazement that we hear of instances in 6745. which parents who have lost one child from the effects of vaccination have been 13,743. prosecuted and fined for refusing to submit another child to the operation.

186. Drs. Barlow and Acland found that about half the cases of vaccinal injury investigated by them (93 out of 189) were of inflammatory or septic origin, and other cases in which the question of syphilis had been raised (38) in many instances proved to belong to the inflammatory or septic category. They further state that "there are a certain "number of cases in which, from causes which cannot at present be foreseen or prevented, serious results ensue from cutaneous eruptions, such as generalised vaccinia, "impetigo, eczema, &c.," though in their experience the number is small. They "are "of opinion that a certain proportion of children will always suffer after vaccination "from various forms of cutaneous eruption. These seem to be more frequent after "vaccination with calf lymph, and are for the most part free from danger, though "often giving rise to considerable distress." They also think that "calf lymph as now "usually employed tends to produce more severe inflammatory reaction than that "which has been humanised."

In regard to the mode of vaccinating Drs. Barlow and Acland state they "have seen "many cases of severe inflammation, abscess, erysipelas, and septic infection which "have followed the use of some mechanical vaccinator," and further, that they "have "frequently seen ulceration result from the insertions being placed too near together, "so that the vitality of the tissues between them has been destroyed, and a slough "produced."

187. Among the 32 fatal cases investigated by Dr. Luff, in which vaccination was a determining cause or factor in the fatal event, there were 22 of erysipelas, three of cellulitis, three of septicæmia, three of pyæmia, and one from exhaustion.

188. Dr. Coupland deals with injuries due to the quality of the lymph, and to septic infection, and adds a third category which he terms "Cases of deranged health, and "even serious symptoms, evolved by the constitutional disturbance induced by "vaccination in weakly or predisposed subjects." In reference to these cases he suggests that "unless small-pox were prevalent at the time it might often be preferable "to defer vaccination for several months than to adhere too rigidly to the statutory "age, irrespective of the condition of the child and its surroundings. In particular "he deprecates the vaccination of very young infants, as is the practice in regard "to workhouse children and those born in lying-in institutions."

189. We were surprised to learn that this highly objectionable practice has been 3963–6. approved and encouraged by the Local Government Board.

190. Erysipelas in varying degrees of severity is the most frequent of the ill results arising from or accompanying vaccination. It may amount to little more than an inflamed arm, or an extension of the areola which surrounds the vesicles on the eighth to the twelfth day, or it may be widespread and severe, affecting the cellular tissue, and may terminate in death. Deaths from "erysipelas after vaccination" were separately classified by the Registrar-General for England and Wales during the years 1859–80; 14,796. there were 390 in all so certified. There is ample reason for believing that many 13,835. 13,839. other such cases have occurred, but in which no mention of vaccination appeared on 14,819. the certificate of death. 14,453. 15,270. 15,355.

Years.	Deaths from Erysipelas after Vaccination.	Years.	Deaths from Erysipelas after Vaccination.
1859	5	1870	20
1860	3	1871	24
1861	2	1872	16
1862	3	1873	19
1863	11	1874	29
1864	13	1875	37
1865	10	1876	21
1866	10	1877	29
1867	4	1878	35
1868	9	1879	32
1869	19	1880	39

Vol. IV., App. iii., Table 3.

15,222. Vol. IV., App., p. 478. 191. At an inquiry held by inspectors of the Local Government Board into certain deaths alleged to have been caused by vaccination at Norwich in 1882, it was shown that eight children suffered from erysipelas "due to some abnormal peculiarity or contamination of the lymph"; four of these died; in only one was vaccination mentioned on the certificate of death.

14,819. Vol. IV., App., p. 466. Another inquiry was made by the Local Government Board into cases of erysipelas following upon vaccination at Gainsborough in 1876, of which six died; in none of these was vaccination mentioned on the certificate of death, though the searching investigation which was subsequently made failed to dissociate the operation from the fatal erysipelas.

14,149. 15,337. Other inquiries have been made by the Local Government Board; in 1886 into three cases of fatal erysipelas after vaccination at Sudbury; in 1887 into a fatal case of erysipelas at a military hospital; and in 1889 into a fatal case of post-vaccinal erysipelas at New Humberston.

192. In addition to the above series of published reports of injuries of an inflammatory or septic character arising from vaccination, we find in a memorandum prepared by Dr. Ballard a selection of cases found among the older records of the Local Government Board. These include:—

1. A series of 19 cases of erysipelas from vaccination at Warrington, with five deaths, in 1871.
2. A case of serious erysipelas from vaccination with National Vaccine Establishment lymph at Stoke Newington in 1871, in which inquiry elicited that violent inflammation had occurred in others vaccinated with lymph from the same vaccinifer; the vaccinifer having an inflamed arm on the thirteenth day and a small abscess in the axilla.
3. Six cases of serious inflammation and three deaths in a series vaccinated with ninth day lymph from one vaccinifer at Appleby in 1873.
4. Several cases of erysipelas and inflammation with five deaths in a series of vaccinations at Chelsea in 1875.
5. Twelve cases of excessive inflammation, six of erysipelas with three deaths, two cases of axillary abscess, and one large ulcer in a series of vaccinations at Plomesgate in 1878.
6. Ten cases of erysipelas or abscesses with four deaths and several cases of eczema in a series of vaccinations at Clerkenwell in 1879, in which "it is clear that the "erysipelatous contagion was imparted at the time of vaccination."
7. Three cases of extensive erysipelas from vaccination at Blandford in 1883.
8. Three fatal cases of erysipelas from vaccination at Sudbury in 1883.

193. Between 1st November 1888 and 30th November 1891, 132 cases of inflammatory or septic disease (mostly erysipelas), following vaccination and terminating fatally, were the subject of inquiry by the Local Government Board. They have been classified as follows by Drs. Acland and Coupland:—

Appendix.

Cases in which vaccination was followed by glandular abscess	3	Cases LXXXI., CXXXIII. and CLXIV.
Cases in which vaccination was followed by cellulitis or sloughing and in which there is ground for supposing that the lymph or vaccinator were at fault	3	Cases LX., XCIV. and CXCII.
Cases in which vaccination was followed by cellulitis or sloughing, in which there is evidence of some extraneous source of danger	9	Cases XLII., LXXX., CIII., CXXVI., CXXXII., CXLVI., CXLVIII., CLXXVI., and CCIII.
Cases in which vaccination was followed by erysipelas in which no extraneous cause was found	14	Cases XXIII., XXVIII., XXX., XXXVII., XLI., XLIV., LXXI., LXXXIX., XCVIII., CIX., CXXXV., CXXXVII., CXLIV. and CLXXVIII.
Cases in which vaccination was followed by erysipelas, in which there is evidence to show that either the vaccinator or the lymph were at fault	32	Cases XVI., XXXI., XXXIV., XXXV., XL., LXV., LXIX., LXXXIII., LXXXIV., LXXXV., C., CI., CIV., CVIII., CXVI., CXVIII., CXX., CXXVIII., CXLI., CXLII., CLV., CLXVI., CLXVIII., CLXIX., CLXXII., CLXXIV., CLXXIX., CLXXXV., CLXXXIX., CXCVII., CXCVIII. and CXCIX.

Cases in which vaccination was followed by erysipelas, in which there is evidence to show that there were extraneous sources of danger apart from the method of vaccination or the lymph - -	43	Cases XV., XVII., XX., XXI., XXIV., XXIX., XXXII., XXXIII., XXXVIII., XXXIX., XLIII., LXII., LXVII., LXXXVI., LXXXVII., LXXXVIII., XCII., CVI., CXIV., CXVII., CXXII., CXXIII., CXXIV., CXXXI., CXXXIV., CXXXVI., CXXXIX., CXLV., CXLIX., CLI., CLII., CLVI., CLIX., CLXVII., CLXXV., CLXXVII., CLXXX., CLXXXII., CXC., CXCI., CXCV., CC. and CCII.
Cases in which vaccination was followed by erysipelas, in which the vesicles were irritated or the scabs injured -	8	Cases XVIII., XXII., XXV., LXVIII., CXIII., CXV., CL. and CLIII.
Cases in which vaccination was followed by ulceration of vesicles - -	4	Cases CLXXIII., CLXXXVIII., CXCIII. and CCI.
Cases in which vaccination was followed by pyæmic or general sceptic infection and in which there is ground for suspecting that the lymph or the vaccinator were at fault - - - -	5	Cases LXXXII., XCVII., CVII., CVII. (*a*) and CXXI.
Cases in which vaccination was followed by pyæmia or general sceptic infection, in which there is evidence of insanitary surroundings or other sources of danger	11	Cases XXVII., LIV., LIX., LXX., LXXVIII., LXXIX., XCI., CV., CXII., CXXV. and CCIV.
Gangrenous, or phagedænic ulceration -	1	Case XIX.

194. Numerous cases, and two or three series of cases of post-vaccinal erysipelas, have been investigated by medical men appointed by the Commission. (See Cases 23, 115, 181, Appendix.)

Thus at some villages in Norfolk in 1890 there occurred a series of injuries from vaccination, which were investigated by Dr. Barlow on behalf of the Commission. In the course of March in that year some 16 children suffered from inflamed arms, several exhibiting secondary abscesses in the axillary glands, with subsequent wasting and great disturbance of health. Three terminated fatally; in one of these the death was certified to be due to “convulsions,” in another to “pyæmia,” and in the third to to “asthenia, tabes mesenterica.” Dr. Barlow’s conclusion on these cases is as follows:— 14,890.

“Analysis of these cases shows that the progress of the vaccination in some respects diverged from the typical course.

In the majority there was a premature development of the vesicle, which within two or three days after insertion formed, broke, and discharged.

In several there was prolonged ulceration with free discharge, but not in the cases I saw any very deep loss of substance.

There was early and inordinate amount of inflammatory redness of the affected limb, and in some cases of the whole body.

In one case (XIII.) there was definite and severe erysipelas.

In two cases there was a large diffuse secondary abscess of the leg, which was very serious indeed, and accompanied by great exhaustion. I am informed that this condition was also observed in one of the fatal cases (C. W. W.).

In one case (No. II.) the local condition was, I am informed, distinctly subsiding, and there was no indication of secondary abscess; but the child died from convulsions. Also in XII. the local condition had quieted down, so that the vaccination sites were very small and scabbed over, and there were no indications of secondary abscess. But the child had sunk into a condition of marasmus with vomiting, and latterly green loose evacuations had been present. He succumbed the day after I saw him.

I think it important to observe that in both II. and XII. the feeding of these infants had been very bad.

For the most part, however, it is clear that the children had been previously healthy, and with two or three exceptions the mothers seemed to me to have been healthy. In two cases (VI., XIII.) there was reason to believe the mothers suffered from local inoculations from attending on their infants.

I saw no reason to think that the other children in the several cottages were unhealthy, with one slight exception (XIII.).

The cottages were fairly wholesome. There was no proof of the family health having suffered previous to the vaccination. The infants vaccinated were, with a few exceptions, well tended.

I could not ascertain that there had been any infectious fever prevalent in these villages which could have modified the vaccination in an adverse way.

To sum up from the brief provisional investigation that I was able to make of these cases, it appeared to me obvious that some septic material had been introduced at the time of the insertion of the vaccine lymph, and that this was mainly responsible for the untoward results obtained." 9835–8844.

(See also cases Nos 5, 6, 7, 11, 14, 21, 27, 28, 30, 32, 36, 38, 39, 54, 72, 73, 81, 83, 86, 87, 88, 91, 96, 100, 104, 105, 106, 107, 108, 112, 114, 115, 116, 117, 118, 121, 122, 124, 125, 126, 135, 137, 156, 158, 161, 162, 165, 167, 169, 171, 175, 177, 179, 181, 183, 184, 185, 188, 189, 190, 197, 199, 200, 203, 204, 206, 207, 208, 211, 213, 215, 217, 218, 219, 220, 221, 235, 236, 239, 241, 242, 244, 245, 247, 248, 249, 253, 257, 258, 259, 260, 261, 262, 267, 268, 271, 312, 318.) Appendix.

195. An account of a somewhat similar series of cases of septic poisoning occurring in the course of some vaccinations at Asprières (Aveyron) in 1885, in which several deaths occurred, will be found in Appendix IV. to the Third Report, p. 210.

196. The question has been much debated whether the erysipelas which accompanies or follows vaccination is due to accidental contamination, or is in some way incidental to or provoked by the changes which result from the insertion of the lymph. The question is not a new one. Jenner described "erysipelatous inflammation" as characteristic of the true as opposed to the spurious cow-pox. When this opinion of his was criticised, he replied, "In calling the inflammation that is excited by the cow-pox "virus, erysipelatous, perhaps I may not be critically exact, but it certainly approaches "near to it." And, indeed, he records an instance in which, in his opinion, the true cow-pox was excited in a herd of cows, and communicated to milkers, by matter derived from "an extensive inflammation of the erysipelatous kind, appearing without any "apparent cause upon the upper part of the thigh of a sucking colt."

4102. 13,073. 13,083–6. 11,218–25. 27,133. 29,112–29,131. 11,059–11,111.

197. The areola around the vesicles when at their height varies a good deal, and it does not seem possible to discriminate with precision between an exaggerated or indefinitely extended areola and erysipelas or erythema. We learn from bacteriological investigations that vaccine lymph contains a great variety of germs or micro-organisms, some of which are accounted to be pathogenic or disease-producing, and though none of them have been identified as the active principle of the vaccine disease, it seems clear that in some specimens germs believed by high authorities to be those of erysipelas have been encountered.

198. In view of these facts we are unable to regard vaccination as being as innocent of erysipelas as a prick of a pin or any ordinary surgical wound. While doubtless the treatment of vaccinated arms is frequently careless, and the surroundings of vaccinated infants often insanitary, and such circumstances may well provoke or aggravate untoward results, the evidence leads us to believe that vaccine lymph or the vaccine process is not unfrequently proximately related to erysipelas, inflamed arms, ulceration, sloughing, and axillary abscess.

Vol. IV., p. 478.

Norfolk series. (Case 23.)

Cases 189, 200, 203.

199. Attempts have been made to discriminate cases of erysipelas following vaccination in which the disease is due to contamination of the lymph, from others in which some extrinsic cause is alleged. It has been suggested that the interval which elapses between the vaccination and the appearance of the erysipelas may enable the discrimination to be made. But the duration of the incubation period of erysipelas is variously given by authorities from a few hours to several days or a fortnight. In certain series of vaccinations, where several of the children vaccinated at or about the same time have been affected, and in which, therefore, the lymph was the probable medium of infection, the interval has varied from one or two days to two weeks, or even longer. It is therefore not possible to exonerate the lymph with certainty by means of any such criterion. It has also been argued that in cases in which one or two children only out of a group of several children, vaccinated from one and the same vaccinifer, subsequently develop erysipelas, that the lymph must be held blameless. But it has been specially remarked by Mr. Hutchinson that in cases of vaccino-syphilis it is not usually the case for all the co-vaccinees to be infected, though in such occurrence it is held that the lymph contains and imparts the superadded disease. (Illustrations of Clinical Surgery. Fasc. VI.) It is not at all improbable that the power of resistance in different children to the infection of erysipelas varies con-

siderably, and it may well be that vaccine which usually evokes an areola or erythema of varying extent may in certain constitutions develop erysipelas or cellulitis. See Case 115 (series) in Appendix.

200. In a memorandum which accompanies the report of the German Vaccination Commission, it is stated that :—

"At the time when the vaccination law was promulgated the opinion, prevailed 9957–61. generally that the dangers connected with vaccination to the life and health of the patient were unimportant, or rather, did not exist at all. Thus it is set down in No. 4 of the final conclusions of the opinion drawn up by the Royal Prussian Scientific Deputation for Medical Affairs, dated February 28th, 1872, which document formed the principal basis for the projected law, 'that there existed no warranted fact in favour 'of a deleterious influence of vaccination upon the health.' It was, however, seen subsequently, very clearly, that this thesis could not be upheld. In fact, very serious damage by vaccination has occurred anything but rarely, both before and after the promulgation of the vaccination laws. The more recent publications enumerate a great many cases of the transmission of contagious diseases by vaccination. Thus, up to the year 1880, 50 cases have become known in which syphilis inoculated with the vaccine caused illness to about 750 persons (Lotz on Small-pox and Vaccination, 1880, page 113). A few separate cases of vaccine syphilis may perhaps be looked upon as being uncertain, but, on the other hand, others were not made publicly known, so that the figures quoted above are likely to be less than the number of cases that happened in reality. Still greater dangers than those connected with vaccine syphilis are threatened by vaccine erysipelas, which, as is now generally admitted, are far from uncommon. It is true that in many cases erysipelas may not be absolutely ascribed to vaccination, notably in the case of separate illness or the so-called late-erysipelas. However, a number of cases of general illness taking place *en masse* have been registered. which happened immediately after vaccination, and, in accordance with the latest experience derived from the etiology of erysipelas, admit of no other explanation beyond their having been caused by vaccination direct. Other diseases also have been transmitted by vaccination, or at least the possibility of such transmission must be admitted."

201. In regard to vaccine syphilis, in the pamphlet revised by the Local Government Board, and until recently widely circulated, it was stated :—

"The fear that a foul disease may be implanted by vaccination is an unfounded one. 21,854. Such mischief could only happen through the most gross and culpable carelessness on the part of the vaccinator; and as all medical men now receive special training in vaccination, no risk of this kind need be at all apprehended. Of course, vaccination, like everything else, requires a reasonable amount of care in its performance. *The alleged injury arising from vaccination is, indeed, disproved by all medical experience.*"

It was not only maintained that care could prevent all ill results, but it was asserted on high authority that "a well-formed vaccine vesicle is certain proof of a pure and unmixed "vaccine lymph"; that a syphilitic vaccinifer must betray evidence of disease sufficient to forewarn the careful, and it has been stoutly maintained that it was the presence of blood in the lymph that occasioned the danger of transmitting syphilis, and that as all lymph sent out in tubes from Whitehall was microscopically examined so as to exclude the presence of blood cells, the danger was infinitesimal. Simon's 1857 Papers, p. 138. 21,853.

202. We agree with our colleagues that the possibility of vaccine syphilis, formerly denied, has been fully established. Section 420.

203. In this connection we recall the words of the late Sir Thomas Watson, F.R.S., late President of the Royal College of Physicians. Alluding to the risk we are considering he said ('Nineteenth Century' June, 1878): "I can readily sympathise with, and even "applaud, a father who, with the presumed dread or misgiving in his mind, is willing "to submit to multiplied judicial penalties rather than expose his child to the risk of "an infection so ghastly."

204. We agree with Mr. Hutchinson that "it is absurd to assert that inherited syphilis "is always to be detected, and it is a cruel injustice to imply that all accidents [of "this kind] have been the result of carelessness." Archives, October 1890, 30,943–4. Sir J. Simon has published a later view in which he states that "it is certain that the vaccine lymph of the syphilitic "infant may possibly contain the syphilitic contagium in full vigour, even at moments "when the patient, who thus shows himself infective, has not on his own person any "outward activity of syphilis." Quain's "Dictionary of Medicine," 182.

205. A committee consisting of Dr. Bristowe, Professor Humphry, Mr. Hutchinson and Dr. Ballard, reporting upon a well-known case, said "it is conclusively proved that it is 30,971.

Report, L. G. B., 1882–3. M. O. H. supplement. "possible for syphilis to be communicated in vaccination from a vaccine vesicle on a "syphilitic person, notwithstanding that the operation be performed with the utmost "care to avoid the admixture with blood." And it is recorded that in this case the vesicles from which the lymph was taken were described as "normal in appearance "and not inflamed."

27,327–9. Sect. 430. 206. Dr. Husband, of the Vaccine Institution of Edinburgh, has established the fact that all lymph, however pellucid, does really contain blood cells. This not only disposes of the theory that lymph may be rendered innocent of harm if blood be excluded, but 4059–70. appears to render somewhat superfluous the labours of the microscopical examiner of 4140. 4159. lymph at the National Vaccine Establishment at Whitehall. Such microscopical exami- 4173. nation of lymph, being directed mainly to the exclusion of that which according to Dr. 4199–4200. Husband is omnipresent, and being admittedly insufficient to detect and identify micro-organisms of pathogenic nature, it is not suprising that it affords no guarantee of the purity of lymph.

207. There is ground for believing that other cases have occurred which circumstances have prevented others from making public. Mr. Ward in giving evidence on the Leeds case incidentally referred to other cases.

208. A list of cases of vaccino-syphilis will be found on page 617 of our Sixth Report. 10,215. Not only is the danger of vaccine syphilis now admitted to be "real and very important," 23,666. 21,854. but the safeguards which have been laid so much stress upon are now known to be illusory. It remains to be considered whether the use of calf lymph will, as has been suggested, obviate the occurrence of syphilitic symptoms as the result of vaccination.

209. This subject is closely connected with what is known as the Leeds case of vaccino-syphilis. In view of the publicity which has been given to, and the importance of the issues involved in, this case, we think that the mode in which it has been dealt with in section 427 of our colleagues' report can scarcely be regarded as satisfactory.

The child in question was vaccinated in March 1889, and died at the Leeds Infirmary on July 1 in the same year. An inquest was held at which Messrs. McGill, Ward, Littlewood, and Dr. Barrs, all members of the infirmary staff, testified to the fact that the child died from vaccino-syphilis. The verdict of the jury was that the child "died "from syphilis acquired at or from vaccination," and a rider was added to the effect that "when a parent requests calf lymph it is the duty of the medical man performing "the operation to supply it if obtainable, or to explain to the parents his inability to "comply with their request."

On July 17, 1889, Dr. Ballard, one of the medical inspectors of the Local Government Board, received instructions, in the usual way, to inquire into the case, and he reported to the Board.

On February 27, 1890, in reply to a question in the House of Commons, Mr. Ritchie, then President of the Local Government Board, stated that "an inquiry has been made 23,686. "by an inspector of the Board with regard to the case. His conclusions are not the "same as those arrived at at the inquest. He states that the child in question was the "only sufferer from subsequent syphilis among all the children he reached and whom "he saw that had been vaccinated with the same or any other lymph in the whole course "of the vaccinator's March vaccinations; and further that the entire family to which "the alleged vaccinifer belonged were, as far as he could discover by examination of "them, free from any syphilitic taint or suspicion of such taint. The report of the "inspector will be at the disposal of the Royal Commission on Vaccination."

The above reply implies, and the report of Dr. Ballard states, that the child died from hereditary syphilis. He alleges that the family of the deceased child was "a 23,701. "syphilitic family." He adds, "This conclusion is the direct contrary to that arrived "at by the coroner's jury, as also by the surgeons at the Leeds Infirmary. Both the jury "and the surgeons formed their opinions on the evidence and statements they received. "If both came to an incorrect conclusion, as I hold they did, it was because they "had not before them the whole story, as I have discovered and narrated it, and "they were consequently misled."

210. Here the matter would probably have terminated as far as official inquiry went had the Commission not been sitting.

It was, however, agreed to ask Dr. Barlow to make an independent inquiry into the history of the case and the health of the family. He has reported to us that there is "no evidence of syphilis" in either parent of the child, and there is "no evidence of "inherited or acquired syphilis" in either of the two elder children, and further, he adds, "nor does the history of the third [deceased] child suggest to me that it was "the subject of inherited syphilis." On June 18, 1891, the results of Dr. Barlow's inquiry were stated by the President of the Local Government Board in the House of Commons in reply to a question by Mr. Herbert Gladstone.

We have since examined Messrs. Littlewood and Ward and Dr. Barrs, who adhere
to the opinion that the child died from syphilis acquired by vaccination, and confirm 23,701–3.
the opinion of Dr. Barlow that there was no suspicion of syphilis in the parents of the 23,838–47.
child or their elder children.

Mr. Hutchinson has also in a publication (Archives of Surgery, Vol. 1, No. 2) added the weight of his testimony to the fact that there is no evidence of syphilis in any of the family.

211. What then was the nature of the disease from which the child died? This question involves the larger question of the relationship of cow-pox and syphilis, between which diseases Dr. Creighton suggests that there is a close analogy.

212. Our colleagues hold, in accordance with the opinion on the case which Mr. Sect. 127.
Hutchinson published, that "it may probably be classed with a few others as
" examples of gangrene and blood poisoning, the direct result of vaccination, which are
" not to be explained by supposing the introduction of any syphilitic or other poison."

213. It has indeed quite recently been recognised that it is possible for vaccination,
even where the matter has been derived from the calf, to give rise to a certain train of 21,989.
symptoms (including snuffles, thrush, eruptions on the genitals, bubo in the arm-pit, phagedænic sores and nodes), symptoms, which have hitherto been regarded as peculiar to syphilis, and which in some cases have been benefited by mercurial treatment. The real nature of such cases has given rise to much dispute; well-experienced surgeons, who saw these symptoms and examined them carefully, thought they could be none other than those of syphilis. Others of high authority regard them as "vaccinia" in a severe form. Dr. Creighton explains all such cases, as well as those of vaccino-syphilis, as due to cow-pox without contamination by human syphilis. Whatever their real nature, it is impossible to refuse to recognise them as the direct consequences of vaccination. Fuller knowledge is required to explain them, but when the assertion is made that the *transmission* of syphilis by vaccination is exceedingly rare, it must be borne in mind that the fact that vaccination with calf lymph, and therefore independent of venereal contamination, is capable of evoking symptoms indistinguishable by experienced surgeons from those of syphilis, has only recently been brought to the notice of the profession.

Mr. Hutchinson says these cases look to him quite as much like vaccinia as syphilis, Archives of
and were so closely parallel that were syphilis conclusively proved in any one, he would Surgery, Oct. 1889.
be prepared to admit it in the others. 21,989.

The publication of these cases brought to light others of a similar kind, including Do., Jan.
several cases in the practice of a public vaccinator in which the four vesicles merged 1890.
into one deep ulceration and took months to heal up, and another series in which the lymph had been taken from a child who was vaccinated from calf lymph from the Local Government Board. In this last series there was not the same gangrenous
inflammation as in the others, but a persistent formation of scabs. (*See also* Cases 11, 21, Appendix.
31, 35, 39, 113, 162, 167, 169, 175, 177, 183, 199, 202, 204, 206, 207, 208, 214, 241, 258, 326.)

214. In view of the fact alluded to in our colleagues' report that these abnormal results Archives of
may follow vaccination *with calf lymph*, the following words of Mr. Hutchinson are Surgery,
significant: "The final supposition is that it is possible for vaccination independently Jan. 1891.
" of any syphilis, whether implanted or hereditary, to evoke symptoms which have 21,975.
" hitherto been regarded as peculiar to the latter malady, and which are apparently
" greatly benefited by specific treatment."

215. This view of the affinity and results of cow-pox is that which was foreshadowed 11,451.
in the writings of Auzias-Turenne, and which in this country has been chiefly advocated 21,973.
by Dr. Creighton. 5573.

216. The remarkable increase of infantile syphilis, which some statistics show since 1853, has not received an adequate explanation. There is much to be said against setting the increase down to vaccination. We should only have expected vaccination to be to a very slight extent the cause of deaths from syphilis, and likely to be overshadowed by more potent influences, unless indeed there were ground for believing,
as has been alleged on high authority, " that a large proportion of the cases of 10,205.
" apparently inherited syphilis are in reality vaccinal."

217. As regards leprosy, the evidence is conflicting. It appears to be a general opinion that among the various means by which the disease is propagated, inoculation is one; and this is held to be rendered more probable by the discovery of a bacillus which
many authorities recognise as the cause of leprosy. This bacillus has been found by 9991.
Arning in vaccine lymph. Several cases are on record in which the disease seems to 10,109.
have been conveyed to healthy persons by discharges from lepers gaining access to raw 18,895.
surfaces; and there are a certain number of individual cases in which medical men of 19,104. 10,094.

19,164–6. 9993. 18,106. experience have concluded that vaccination has been the means of such communication. There is no doubt that in the West Indies, and in other leprous countries, a general suspicion exists that native lymph may transmit leprosy; but evidence of wholesale propagation by this means is scanty and inconclusive, the most suggestive instances being those related by Arning in the Sandwich Islands.

218. In addition to inflammatory and septic complications, vaccination not unfrequently gives rise to skin eruptions. These vary immensely in character, and it is only in the most exceptional cases that a vesicular or pustular eruption like that of variola occurs. It has indeed been remarked that "the wonder is not that vaccination should sometimes produce an exanthem, but that it should ever be without one." (Hutchinson, Lectures on Clinical Surgery I., i. 18.)

These secondary skin eruptions evoked by vaccination have by the French pathologists been termed *vaccinides*. They may be roseolous, or papular (Lichen or Prurigo) or eczematous or impetiginous in type. (Fournier, Leçons sur la Syphilis Vaccinale, pp. 129–33.) They may be very transient and trivial, or may become chronic and persistent, and in a few cases have caused death. (*See* Cases 12, 14, 25, 29 35, 82, 95, 98, 109, 120, 129, 130, 138, 173, 180, 193, 196, 208, 214, 240, in Appendix.)

219. In reference to the possibility of consumption, tubercle or scrofula being communicated or occasioned by vaccination, it is necessary to bear in mind the prevalent belief that these diseases are due to a specific organism, and the fact that it has been found that tubercular disease can be readily conveyed from infected animals to healthy animals or persons by the medium of infected animal products such as milk. It seems that in a few cases a local development of tubercle in the form of lupus has taken place at the site of vaccination (*see* case 26, also evidence of Mr. Dakers, VI Report, 21,219–83). In a few other cases the question has arisen whether constitutional infection of tubercle has not been evoked by vaccination. In a larger number of cases strumous symptoms, following upon the disturbance of health occasioned by vaccination, have raised the question of the relationship of the one to the other (*see* Cases No. 128; 52 (?); 89; and 131.)

Thus Professor Felix von Niemeyer has expressed the view that—

22,648–50. "The injurious influence which diseases have on the constitution, and thereby on the tendency to consumption, manifests itself most frequently and in the most lasting manner in earliest infancy. It is fortunate if children escape disease, particularly in the first years of their life, during which by far the most rapid development of the body takes place, and when by favourable or unfavourable external circumstances the foundation is laid, in a great measure, for a strong and robust, or a weak and delicate, health. Even vaccination may, by the febrile disturbance preceding the eruption, as well as by that accompanying the suppuration, both of which are never absent, and, according to my numerous thermometrical observations, sometimes reach a very high degree, considerably weaken, more especially those children who are not very strong, and may leave behind it the germs of a disposition to consumption."

22,714. The experiments of M. Toussaint indicate the possibility of inoculating tubercle upon animals by vaccination. A paper by M. Dumontpallier on a series of casualties from vaccination in Paris in the "Rapport sur les vaccinations pratiquées en France," 1875, tends to suggest a similar possibility in the human subject. While cases of this kind would appear to be rare, we have little doubt the explanation quoted from Dr. Niemeyer would hold good in a larger number of cases.

220. It will have been observed that the diseases which have been alleged to have been conveyed by vaccination are those which modern pathology has shown to be inoculable, and we are bound to conclude that it is possible in the act of vaccination to convey any disease whose cause can reside in the inflammatory lymph of a vaccine vesicle.

770. *Reference II.—Means other than Vaccination for diminishing the prevalence of Small-pox.*

930. 221. We are quite unable to agree with those who have maintained that sanitary measures have little or no influence upon small-pox. We have already given our reasons for thinking that the teaching of the early sanitarians, like Howard and Haygarth towards the close of last century, initiated a new line of thought in the prevention of disease, and we believe the general improvement of the public health which then set in was due, in a large measure, to a greater sanitary activity, and that the falling off in the death rates of fevers and small-pox, as well as in the general death rate, is confirmatory of this view.

222. In speaking of sanitation we use the word in its widest sense; we are not speaking merely of drainage improvements, but we include the prevention of overcrowding on areas, or within houses and rooms, the proper constructions of dwellings, so as to permit thorough ventilation; the promotion of cleanliness by adequate water supply and the prompt removal of filth accumulations. Related to these measures, but in

a somewhat different category, are means directed against contagion, the speedy separation (in suitable hospitals) of the infected from the healthy, the disinfection of persons and things, and the prevention of the propagation of the disease by inadvertent carelessness or by intentional inoculation.

223. If the view that attributes small-pox exclusively to contagion be well founded, it might indeed be possible to keep out the disease even from insanitary places by rigid isolation; but experience shows that some, even of the contagious diseases, are dependent for their extension and severity upon influences other than contagion. The Royal Commission on Infectious Hospitals in 1882, in their report, called attention to the fact that the opportunity for contagion which the presence of a small-pox hospital might afford to a particular neighbourhood, is insignificant as compared with other deleterious influences from which London suffers. The returns and maps showed "that a healthy neighbourhood in which a hospital has been planted, though to a certain extent injured, may yet be favourably compared as regards prevalence of small-pox with those localities in which from over-population and neglect of sanitary precautions the predisposing causes of disease are more deeply seated."

Report of R.C in S.P. and Fever Hosps., p. xxiii.

224. We agree with the epidemiologist Hirsch that "small-pox, as well as typhus, takes up its abode most readily in those places where the noxious influences due to neglected hygiene make themselves most felt." (Hist. & Geo. Path., Vol. 1, p. 481.)

225. We find our own great sanitarian, Edwin Chadwick, in formulating his conclusions on the prevention of epidemics, while urging the separation of the unaffected from the affected when an outbreak occurs, yet maintained "that cases of small-pox, of typhus, and of others of the ordinary epidemics, occur in the greatest proportion, on common conditions of foul air from stagnant putrefaction, from bad house-drainage, from sewers of deposit, from excrement-sodden sites, from filthy street surfaces, from impure water, and from overcrowding in private houses and in public institutions."

"That the entire removal of such conditions by complete sanitation and by improved dwellings is the effectual preventive of diseases of those species, and of ordinary as well as of extraordinary visitations."

226. There is evidence to show that in countries where, at the present time, sanitation has not made much advance, or where overcrowding, filth accumulation, non-isolation of the infected, and, in some cases, the continued practice of inoculation prevail, small-pox is still rife, in fact endemic, and its persistence is attributed to these causes, and that where these causes exist vaccination entirely fails to neutralise them.

227. Thus in the official sanitary reports from India, published annually, we find frequent references to the influence of such causes upon the prevalence and mortality from small-pox:—

In the Report on Sanitary Measures in India, in 1879–1880, p. 142, it is stated:— "The vaccination returns throughout India show the same fact, that the number of vaccinations does not necessarily bear a ratio to the small-pox deaths. Small-pox in India is related to season and also to epidemic prevalence; it is not a disease therefore that can be controlled by vaccination in the sense that vaccination is a specific against it. As an endemic and epidemic disease it must be dealt with by sanitary measures, and if these are neglected small-pox is certain to increase during epidemic times."

Again, in the report of the Army Commission of the Punjab for 1879, p. 186, it is stated: "Vaccination in the Punjab, as elsewhere in India, has no power apparently over the course of an epidemic. It may modify it and diminish the number of fatal cases, but the whole Indian experience points in one direction, and this is that the severity of a small-pox epidemic is more closely connected with sanitary defects, which intensify the activity of other epidemic diseases than is usually imagined, and that to the general sanitary improvement of towns and villages must we look for the mitigation of small-pox as of cholera and fever."

It is stated again in the Report for the Central Provinces, p. 206: "The past comparative immunity of the population had been attributed to efficient vaccination, and the people had accepted this protection, but their confidence has been shaken by the re-appearance of a severe form of this disease. The sanitary commissioner states that he directed a special report on the subject to be made with the following result: 'During the early part of the year there had been a good deal of chicken-pock in Sambulpur town; that when small-pox broke out later on, it attacked those who had been inoculated, vaccinated, and had previously had small-pox or chicken-pock; 301 persons who had been inoculated took the disease; that 577 vaccinated persons were attacked and 729 unprotected persons, or 1,607 in all.'"

Again in the Report for 1884–5, p. 203, referring to the sanitary measures of the North-West Provinces and Oudh, it is noted: "The facts already stated show conclusively that the small-pox of 1884 was one of the most severe epidemics on record, and by far the most severe in these provinces since deaths were registered. We are thus

" brought face to face with the fact that notwithstanding the existence of an active
" vaccination service, small-pox swept over the provinces just as if there had been none.
" No doubt attacks and deaths had been prevented by the service, but it is clear that
" it has been incompetent to deal with the disease in its epidemic form."

Again, it is stated that, " as a matter of fact, the total vaccinations at all ages
" performed by this staff amounted to less than three times the number of deaths, and
" the operations under one year of age were not one and a half times the total deaths.
" These remarks are not intended to call into question the utility of vaccination. But
" in presence of the facts the question is a perfectly relevant one, namely, whether
" dependence can henceforth be placed on vaccination as a protection against a small-
" pox epidemic ? The question of course answers itself. In ordinary years lives are
" no doubt saved, and lower small-pox death rates may be co-existent with numerous
" operations. But this and similar experience appears to show that the remedies, if
" such be available, will have to be extended beyond vaccination, and will have to
" deal with epidemic causes affecting localities and their inhabitants. If sanitary work
" be neglected no more dependence against small-pox epidemics can be placed on
" vaccination than can be placed on quarantine against invasions of cholera. The
" true remedies lie elsewhere altogether."

Inoculation is still practised in India, in many places, and in association with religious observances, in honour of Sitla, the goddess of small-pox. In Persia inoculation is still to a large extent the custom; small-pox is endemic and the majority of children suffer from the disease at an early age.

228. In Nubia and the Soudan inoculation is still practised, the disease being regarded as a necessity, and the mortality is stated to be high, especially among the blacks.

8128. In Algeria small-pox is said to be endemic; the Arabs still practise inoculation, the
Vol. vi., most elementary precautions against contagion are neglected, and the treatment of the
App. p. 756. disease is like that in vogue here before the time of Sydenham.

p. 747, 229. There can be little doubt that social position and sanitary environment have a
8128. potent influence on the prevalence as well as on the fatality of small-pox.

Dr. Farr, before the days of compulsory vaccination, pointed out the effect on causes of mortality of the selection exercised by insurance companies. Death from the eruptive fevers among such selected lives was rare; among 4,095 deaths in the Equitable Society, during the years 1801–32, only one was from small-pox.

In the Norwich epidemic of 1819, Crosse noted that the epidemic was almost exclusively confined to the very lowest orders of the people.

The late Earl of Shaftesbury, in the debate on the Compulsory Vaccination Bill of 1853, observed that " it was perfectly correct that the small-pox was chiefly confined
" to the lowest class of the population, and he believed that with improved lodging-
" houses the disease might be all but exterminated."

230. In 1875 Dr. Farr constructed life tables based upon the vital statistics of, (1) All England, (2) Liverpool, and (3) healthy districts, in order to ascertain what effect healthy environment had upon zymotic diseases. His figures showed that—

For every MILLION BORN ALIVE there would die, according to the LIFE TABLES:—

Supplement to 35th Annual Report of Registrar-General.

——	In Healthy Districts.	In England.	In Liverpool.
By small-pox - - -	2,359	6,521	8,141
By fevers - - -	28,146	38,107	76,563
By measles - - -	6,912	12,865	26,973
By whooping-cough -	10,234	15,161	34,021
By scarlatina - - -	21,403	30,021	38,302

Dr. Farr, commenting on these remarkable figures, states his opinion " that healthy
" sanitary condition as to food, drink, and cleanliness of person, house and city, stands
" first in importance; after it, but subordinately, come quarantine, vaccination, and
" other preventives, as means of subduing mortality; for the mere exclusion of one
" out of many diseases appears to be taken advantage of by those other diseases, just
" as the extirpation of one weed makes way for other kinds of weeds in a foul garden."

231. That the difference observed between the figures for Liverpool and the healthy districts is not merely due to the denser population of the former affording greater opportunity for infection, is, we think, shown by the fact that in industrial dwellings, where there is a considerable aggregation of persons upon area, but under superior sanitary supervision, there has been a marked immunity from small-pox. Dr. Southwood Smith long ago called attention to this fact (Results of Sanitary Improve-

ments, p. 17.), and we learn from the Secretary of the Improved Industrial Dwellings Company that, in 1880–82, there were but two deaths from small-pox among more than 15,000 tenants, while there were 3,268 small-pox deaths in those years in London with a population of 3,800,000.

232. At Warrington in 1892–3 Dr. Savill notes that a relation existed between small-pox rate and house rate. All but 11 of the 455 infected houses were rated at less than 16*l.* per annum, and 406 of them at 8*l.* and under; with the exception of these eleven, the small-pox was absolutely confined to the lower, or artisan, or working classes, whose gregarious habits pre-eminently favour the spread of the disease from person to person. Warrington Rep., p. 87.

233. At Dewsbury we learn from Dr. Coupland's report that the sanitary condition of the union was anything but satisfactory. In 1878 a disproportionately high mortality from fever had occasioned a special investigation. It was found that the mean death rate from this cause had been 8·3 per 10,000 in Dewsbury, against 4·1 in London and 5·4 in the large towns of England. Although some improvement has taken place since that time there is much still to be done, especially in the matter of excrement disposal and house construction. The back-to-back system of dwellings is still the rule, especially in Batley. With but few exceptions the incidence of the disease fell upon members of the working-class community. Associated with the staple industry of weaving is a very extensive rag trade, the rags come from all parts of the world, and consist of cast-off wearing apparel in all degrees of filthiness. Dewsbury Rep., p.10.

Dr. Coupland observes that in the higher part of Batley, which is mostly residential, but few cases of small-pox occurred. Of the 266 houses in Batley that were invaded, and of which particulars were obtained, 171 had no through ventilation, 122 of these were back-to-back, and seven were cellar-dwellings. In Dewsbury more than 70 per cent. of the invaded houses had no through ventilation. At both places the proportion of cases of small-pox was larger in the houses where there was no through ventilation.

234. In reference to the question of the relation of sanitary measures to small-pox our attention was specially directed to an outbreak of the disease on board the steamship 'Preussen" in 1886. It was suggested that in such a case the influence of vaccination could be measured without the disturbing influence that sanitary circumstances are alleged to exert. The case appears to have attracted considerable attention, and was quoted by the President of the Local Government Board, in the House of Commons debate of July 22, 1887, as strikingly showing the efficiency of vaccination (Hansard 22, VII., 1887, p. 1799).

It was stated in evidence "that the Local Government Board in 1886 took some pains 994.
" to get the figures as to the steamship 'Preussen,' bound for Australia, on board of
" which small-pox broke out. You have, of course, on a vessel, people living under
" the same sanitary circumstances, eating very much the same food, and in all respects
" practically alike, with the one solitary exception of vaccination. There were 312
" persons on board this vessel. Of persons both vaccinated and re-vaccinated there were
" 55, four of those were attacked by small-pox, none died. Of persons vaccinated but
" not re-vaccinated there were 209; 45 of whom were attacked by small-pox and three
" died; 13 persons had previously had small-pox, of whom three were attacked by
" small-pox and none died. Of persons stated to be vaccinated but showing no scars,
" there were 16, two of whom were attacked by small-pox, and none died. Lastly, there
" were 19 persons unvaccinated; 15 of these were attacked by small-pox, and nine
" died. This evidence is in expansion of that I gave, showing that sanitary circum-
" stances have little or no control over small-pox when compared with the condition of
" vaccination or no vaccination."

235. Having examined Dr. MacLaurin, of Sydney, who had personal knowledge of the case, and the official reports from Melbourne and Sydney, we find:—

1. That the vessel was greatly overcrowded, carrying in all 723 passengers; the overcrowding led to a most insanitary state of things on board, and the vessel when inspected at Sydney was pronounced to be the filthiest ship the authorities there had ever had to do with. 5945-6. 5952.

2. In addition to the cases of small-pox referred to in reply to Question 994 there were 29 cases among some 235 passengers who were disembarked at Melbourne. Of these cases 21 were vaccinated (nine with one mark, four with two marks, eight with three marks) of whom one died; seven were "doubtful" or "not stated" as to vaccination, of whom two died; one was unvaccinated and recovered.

3. There were also, in addition, the crew, numbering 120, who had been vaccinated and re-vaccinated; of these fourteen were attacked and one died. 5959–69. 5971–5.

The official report from Melbourne states "it is impossible to doubt that the
" ordinary rules for the preservation of health and enforcement of decency were

" neglected, and we fear the most obvious precautions against the spread of small-" pox were omitted." Dr. MacLaurin, in his official report to the Sydney Board of Health, says, " Had the authorities at Albany, immediately on the ship's arrival, " removed the small-pox patient to the shore, and suitably disinfected the ship, it is " reasonable to conclude that the terrible amount of suffering and danger which has " since ensued might have been almost, if not altogether, averted."

The facts do not appear to us to indicate that means other than vaccination have not a very potent influence over the spread of small-pox; and in this particular case it would seem that while small-pox paid little respect to vaccination or re-vaccination sanitation was conspicuous by its absence.

236. We believe that the growth of knowledge in regard to the mode of propagation and control of contagious diseases, both amongst animals and men, which has signalised the last hundred years, has a most important bearing upon the history and mode of dealing with small-pox.

237. In the earlier years of this century, attention was repeatedly drawn to the great danger of spreading small pox by carelessness in regard to contagion, and especially to the practice of inoculating out-patients at the small-pox hospital, and then allowing them to wander about in all stages of the disease. Mr. S. Bourne, M.P., in the House of Commons said, "If we were to prescribe a mode of spreading the " contagion of small-pox, it would be difficult for human ingenuity to devise anything " better adapted for the purpose than to inoculate out-patients at the small-pox " hospital to the amount of 2,000 in a year, and for these out-patients to resort there " twice a week to be inspected." The objectionable practice of inoculating out-patients was at last given up at the hospital in 1808.

In 1813 Lord Boringdon introduced into the House of Lords a Bill "for more " effectually regulating the spread of infection from the small-pox." He read documents from which it appeared that " owing to the constant open exposure of those who were " inoculated with the small-pox in all stages of the disorder, great numbers were " infected." Lord Ellenborough, in the debate which followed, pointed out that such exposure might be dealt with by indictment under the common law.

Moore, History of Small-pox, pp. 305–6.

In 1815 the National Vaccine Establishment prosecuted in the King's Bench for the exposure of a small-pox patient after inoculation, whereby eleven persons were infected. The Court, in view of this being the first indictment of the kind, sentenced the offender to only three months' imprisonment.

238. The writings of Rast, Haygarth, Faust, and others, published before the advent of vaccination, showed the enormous change which was taking place in the minds of medical men in regard to part played by contagion, and therefore also in regard to the amenability of epidemics to human interference, (*see* sections 456–458 in the report of our colleagues).

239. Some of these writers, like Rast of Lyons, denounced the practice of inoculation as not only fundamentally wrong in principle, in that it tended to keep alive the contagion, but also as a failure in practice, in that it had actually increased the share of the total mortality borne by small-pox. He proposed in 1763 a system of isolation in extra-urban hospitals very like that which we have seen adopted in our own day. Haygarth's writings did much in this country and abroad to familiarise the public and the profession with the possibilities of hospital isolation as a preventive as well as a therapeutic agency, alike in the case of fevers and small-pox.

240 Thus we find in the Medical and Chirurgical Review for the year 1796 (the year in which Jenner performed his first vaccination) a criticism of a work by Faust, of Leipzig, entitled:—" 'An essay on the Duty of Man to separate persons infected with " 'Small-pox from those in Health, hereby to effect the Extirpation of that Disease " 'equally from the Towns and Countries of Europe,' in which it is stated . . . . . " Thus it is proved that the small-pox is not a necessary or unavoidable evil of man-" kind; it can be annihilated, and ought to be; it is a sacred duty to deliver from its " ravages the present and future generations, and we commit a heinous crime in not " using the means in our power to put an end to so dreadful an evil. The question is " by what means can this be effected? The whole mystery is explained in a single " maxim. The first person ill in a place is the only source from which all the rest, " perhaps hundreds and thousands, become affected; let him be put immediately into " a situation where he cannot injure by contact those who have not had the disorder. " It is the duty of the individual and of the community; it is a duty owed to society " and to the human race. We observe this duty when a maniac becomes dangerous to " society, and shall we omit it here where the danger is infinitely greater, and perhaps " causes the deaths of thousands? And in the former, the separation lasts for years, 11,015.

"and perhaps during life, whilst in the latter it is only necessary for a fortnight or "three weeks; for the infectious period lasts only from the time of eruption to the "complete falling off of the pustules. The principal means which M. Faust, therefore, "points out for the execution of this great plan, are:—1. That people of all conditions "should first be instructed by sensible writings that the small-pox is not necessary nor "unavoidable, that its existence depends on our will, and that it is our duty to annihilate "it. 2. A description of the disease with good ideas thereof should be circulated in "all villages, in order that it may be immediately recognised. 3. Near each great "town a moderately large house should be erected for the small-pox, and an inspector "appointed. 4. All the inhabitants of towns and villages should contribute to its "support. 5. As soon as any person is attacked with the disease he should be "immediately removed to a house of this description . . . If these rules are duly "followed, continues M. Faust, it may with certainty be depended on that in five or "six years the small-pox will no longer be found to exist in the civilised part of "Europe, just as the plague itself is extirpated."

241. Even after vaccination had been publicly announced, we find in the same leading 10,893. Medical Review, in 1799, an article on establishments for the extirpation of the small-pox in which mention is made of "the ravages of small-pox since its first appearance "in Europe," and it is stated that "since the year 1721 its mortality in Germany "has been endeavoured to be lessened by the practice of inoculation. But the lists "of mortality show that this desirable end is far from having been fully attained. "Plans for total extirpation of the small-pox, therefore, have been suggested by "philosophers of various countries, and the probability of being able to effect it is "amply shown. To do this, however, the exertions of the physician are incompetent, "unless they be aided by the powerful hand of Governments, but this has hitherto been "withheld. *The grand means, however, of extirpating this destructive malady is an early "and strict separation of the infected from those that are sound.* In the year 1796 the "Prussian College of Physicians made a favourable report to the King on this project, "when it was resolved to establish a house for the purpose in the city of Halberstadt. "It is to be hoped that other countries will at length open their eyes to their true "interest, and adopt a plan which cannot fail materially to affect the population of "Europe. It will not be necessary then to attempt to disarm one disease of its powers "by the introduction of another, the consequences of which cannot be fully known for "a series of years to come."

242. Since vaccination was asserted to give the same protection as inoculation without spreading contagion, a point on which much stress was laid in the report of the House of Commons Committee on Jenner's petition, its acceptance in lieu of the old practice appeared to offer a simpler and surer method of exterminating small-pox than the isolation methods which were being advocated, and these for a long time remained in abeyance while vaccination became the State-adopted method of dealing with small-pox.

243. In 1868 attention was again recalled to the value of isolation in dealing with small-pox by Sir James Simpson in a paper entitled a "Proposal to stamp out small-pox "and other contagious diseases," in which the success which had attended the stamping out system in dealing with certain animal pests was cited as an illustration of what might be accomplished by an analogous system applied to the infectious diseases of 10,981. mankind.

The paper, which will be found at page 40 of the fourth vol. of our reports, is worthy of careful perusal. Sir J. Simpson's contention in brief was:—"For all that appears "necessary for the purpose is simply the methodic temporary seclusion, segregation, "or quarantine of those affected with small-pox, until they have completely passed "through the disease and lost the power of infecting and injuring others. The pole-"axe was the chief and leading measure required to stamp out rinderpest. *Isolation "is the chief and leading measure required to stamp out small-pox.*" And he proceeded to show that by the Public Health Scotland Act of 1867, and less satisfactorily by the Sanitary Act of 1866 for England, the Legislature had for the first time made such action possible to local authorities.

244. It has been largely in consequence of the experience derived from the great epidemic of 1870–72, in which the failure of the compulsory infantile vaccination system became so apparent, that attention has again of late years been directed to the necessity of providing proper hospitals for isolation, and to the enormous influence of such isolation in limiting outbreaks of the disease. Dr. Seaton, the Medical Officer of Health for Surrey, in alluding to the experience of 1870–2 (Brit. Med. Jour., Feb. 29, 1896, p. 521), says:—"The way in which the disease was seen to spread by the sometimes unavoidable

" and sometimes careless exposure of infected persons and things at public-houses, " laundries, provision shops, &c., as well as in the workhouses and common lodging-" houses, forced attention to the question of isolation. This had hitherto been kept in " the background by the habit of relying wholly on vaccination as the great preventive " measure against small-pox. Under the influence of panic small-pox hospitals " so-called were erected, but this did not take place anywhere until the disease had " got firm hold of the population, and consequently they were little or no use in " preventing epidemic diffusion."

245. It is instructive to compare the behaviour of small-pox, typhus, and scarlatina in London during the years of registration for which the figures are available for each of these diseases. The following table enables us to trace the influence which sanitary reforms and hospital isolation have had upon each of these zymotic diseases:—

M. A. B., Report for 1895, and Reg. Gen. Report for 1894.

Years.	Estimated Population in the Middle of each Year.	Annual Death Rate per Million.		
		Small-pox.	Typhus.	Scarlatina.
1838	1,766,169	2,161	—	—
1839	1,802,751	352	—	—
1840	1,840,091	671	—	—
1841	1,878,205	561	—	—
1842	1,917,108	188	—	—
1843	1,954,041	224	—	—
1844	2,033,816	887	—	—
1845	2,073,298	438	—	—
1846	2,113,535	122	—	—
1847	2,202,673	434	—	—
1848	2,244,837	722	—	—
1849	2,287,302	228	—	—
1850	2,330,054	214	—	—
1851	2,373,081	448	—	—
1852	2,416,367	480	—	—
1853	2,459,899	86	—	—
1854	2,503,662	277	—	—
1855	2,547,639	408	—	—
1856	2,591,815	205	—	—
1857	2,636,174	59	—	—
1858	2,680,709	90	—	—
1859	2,725,374	425	—	1,277
1860	2,770,181	324	—	726
1861	2,815,101	77	—	846
1862	2,860,117	128	—	1,221
1863	2,905,210	687	—	1,706
1864	2,950,361	185	—	1,097
1865	2,995,551	214	—	727
1866	3,040,761	457	—	622
1867	3,085,971	436	—	470
1868	3,131,160	191	—	929
1869	3,176,308	87	225	1,839
1870	3,221,394	302	147	1,875
1871*	3,267,251	2,421	118	582
1872	3,319,736	537	52	276
1873	3,373,065	33	82	191
1874	3,427,250	16	91	773
1875	3,482,306	12	37	1,056
1876	3,538,246	207	45	651
1877	3,595,085	709	44	439
1878	3,652,837	387	41	495
1879	3,711,517	120	19	717
1880	3,771,139	124	20	820
1881	3,824,964	617	24	553
1882	3,862,876	110	14	519
1883	3,901,164	34	14	514
1884	3,939,832	307	8	362
1885†	3,978,883	347	7	181
1886	4,018,321	5	3	172
1887	4,058,150	2	5	356
1888	4,098,374	2	2	295
1889	4,138,996	—	4	190

* Opening of Metropolitan Asylums Board Hospitals.

† Small-pox cases isolated out of London.

Years.	Estimated Population in the Middle of each Year.	Annual Death Rate per Million.		
		Small-pox.	Typhus.	Scarlatina.
1890	4,180,021	1	2	206
1891	4,221,452	2	3	142
1892	4,263,294	10	3	273
1893	4,306,411	48	1	369
1894	4,349,166	22	1	222
1895	4,392,346	13	—	—

These figures confirm the conclusion to which the other evidence points, that while sanitary reforms have been followed by a reduction of the mortality from small-pox and fever, the recent development of proper hospital isolation has been most strikingly effectual in reducing almost to insignificance the mortality from those diseases in the case of which it has been most largely resorted to.

246. Prior to 1867 organised removal and isolation of infectious disease in London did not exist. The Metropolitan Asylums Board was then formed, but the epidemic of 1870 had begun before any approach to adequate accommodation had been provided. At first admission to hospital was dependent on the order of a relieving officer, accompanied by a certificate of a district medical officer; but these restrictions have been removed and the Metropolitan Asylums Board's hospitals are now free to *any person* reasonably suspected to be suffering from small-pox, fever, or diphtheria. 39,166–75.

The effect of these increased facilities for treatment of small-pox in isolation hospitals has been that while in 1871–2 only 31 per cent. of the small-pox deaths occurred in hospitals, in 1893 87 per cent. took place therein.

247. On November 16th, 1881, a Royal Commission, of which two of our colleagues were members, was appointed to inquire into the nature, extent, sufficiency, advantages, and disadvantages, &c. of the Metropolitan Asylums Board's hospitals for small-pox and fever, and generally as to the operation of the Acts providing for the establishment thereof. In their report the Commissioners contrast the case of London with that of the provinces in regard to small-pox mortality; they say,—

"We find that from 1871 to 1880 inclusive, the amount of disease in London " relatively to the population, though less than that in several other great towns, has " always been greater than that in England generally, and its rate of diminution " has been slower. In London, however, as in the country, till about the year " 1860, that diminution was always going on. Then a change took place. While the " general provincial mortality continued to decrease, the quinquennial average mortality " of London will be seen by the table to have risen from its minimum of 195 per million " in 1861, to 396 in 1867, and to have continued at a somewhat lower but still comparatively high rate till the statistics of metropolitan small-pox were disorganised by the " exceptional visitation of 1871, and the reaction, amounting to virtual immunity of " the years 1873, 1874, and 1875. During the six following years, 1876–81, the " London rate of mortality has gradually risen, on the quinquennial average, to 393. " Comparing this average with that of 1861, we seem for the last 21 years to have " been grappling with an evil influence which is fitfully but sensibly gaining ground " upon us . . . and which Dr. Munk, the experienced physician of the Small-pox " Hospital at Highgate, believes to be increasing in the severe character of its attacks."

They made certain practical recommendations several of which have been carried out; such as compulsory notification, disconnexion from the poor law, removal of small-pox patients out of London, and the disuse of the intra-metropolitan hospitals for small-pox. The Commissioners were led to hope "that the immediate and complete " isolation which ought to be secured by these means will greatly diminish the amount " of small-pox, scarlet fever, and typhus in London."

They calculated that if their suggestions in regard to notification, &c., were acted on and produced the desired effect, three-fourths of the small-pox cases would find their way to hospital, and three-fourths of the deaths occur there, and thus both the average and maximum number of cases and the mortality from small-pox would be greatly diminished. This calculation has been more than realised, more than 80 per cent. of small-pox deaths in London now occur in hospitals.

They, however, state that, having regard to the 43 years of registration statistics, " if " we assume for the moment that the past is our best measure of the future, it would " seem that we have to expect once in about 30 years an absolute mortality varying " from 8,000 to 10,000 deaths, and, apart from these extraordinary outbursts, that the " sickness of the remaining 41 years will be indicated by a mortality ranging—

In 3 years from 2,800 to 3,600.
,, 17 ,, 1,000 ,, 2,800.
,, 13 ,, 400 ,, 1,000.
,, 8 years being under 400.

41 years."

and that an accommodation for 2,700 small-pox patients would accordingly be a more than safe estimate.

248. The actual deaths from small-pox in London in the years which have elapsed since the Commission of 1881 reported have been as follows :—

1882 - - - -	430
1883 - - - -	136
1884 - - - -	1,236
1885 - - - -	1,419
1886 - - - -	24
1887 - - - -	9
1888 - - - -	9
1889 - - - -	0
1890 - - - -	4
1891 - - - -	8
1892 - - - -	41
1893 - - - -	206
1894 - - - -	89
1895 - - - -	55

It is in the highest degree satisfactory to find that the forecast, based upon the experience from 1838 to 1881, has not been verified by that of the subsequent years London has not for two centuries been so free from small-pox as during the last ten years. In 1889 not a single death from that disease was registered in London; in 1887, 1888, 1890, and 1891 there were less than 10 per annum, and in not one of the last 10 years has the 400 minimum limit, which the Commissioners anticipated would be exceeded in 33 years out of 41, been surpassed. London, instead of comparing unfavourably with provincial towns in regard to small-pox mortality, has come to show better results.

249. To what cause is this remarkable decline of small-pox in London attributable? The excess of London small-pox in the past has been attributed to the relatively large proportion of the births that are unaccounted for as regards vaccination. Has the proportion become less of late? On the contrary, the returns to the Local Government Board show that the proportion of births not finally accounted for as regards vaccination in London has steadily increased from 4·3 per cent. in 1881 to 18·4 per cent. in 1892. We agree with our colleagues in thinking it impossible to attribute the decline
Sect. 472 of Report. to vaccination. In 1885 the Metropolitan Asylums Board began to convey small-pox patients by steamer to the floating hospitals on the Thames at Long Reach. In 1889 notification became compulsory in London, and nearly all the reported cases of small-pox have been promptly isolated in such a manner as not to occasion infection
72,915. from hospitals in crowded neighbourhoods. The comparative immunity that London
1009–1013. has enjoyed of recent years is no doubt due to this policy which has been so vigilantly carried out by the managers of the Asylums Board.

29,173. 250. There are 400 beds in constant readiness at the ships, and additional accommodation is available at short notice at Gore Farm. On receiving telephonic or other communication at headquarters an ambulance proceeds with a nurse to where the patient
29,299. is, and on receiving the certificate that the case is one of small-pox, and without any compulsion, the patient is conveyed to the wharf where the ambulance steamboat is in readiness. Here the patient is seen by a medical officer of the Board, to confirm the
29,174. diagnosis or otherwise. There are three ambulance steamers comfortably fitted up so as to carry 100 acute cases at a time.

251. It is a matter of experience that it is easier to secure notification and isolation in the case of small-pox than in the case of any other infectious disease. The promptness and ease with which an outbreak of small-pox in Marylebone was dealt with successfully by the Board in 1894 afforded a striking illustration.

658.
798.
29,224-5.

252. The Asylums Board has no jurisdiction in regard to disinfection or vaccination, nor is there in London any machinery for quarantining the inmates of infected households. Investigations which have been made in London and elsewhere have emphasized the local and personal infectiveness of small-pox, and the pedigrees of localised outbreaks have been definitely traced to single importations.

29,301.

253. Attention has been of late drawn to the part played by tramps in the spread of small-pox. Mr. Scovell, of the Metropolitan Asylums Board, pointed out the need for greater supervision of "shelters," and for the enforcement of greater cleanliness on the part of the vagrant population who use them. "Small-pox," he says, "is usually "found to be rife among the lower and more uncleanly portion of the popula-"tion." Dr. Birdwood, who speaks from the experience of some 12,000 cases of small-pox, believes that attention to cleanliness and frequent ablutions prevent the spread of small-pox and diminish the amount of eruption; he cites the successful precautions taken against the infection of visitors to the small-pox ships, and the occurrence of discrete small-pox in babies, who are frequently washed, as evidence of the truth of his views.

29,232.
29,274.
31,376.

254. In the last report of the Metropolitan Asylums Board we read, in reference to the recrudescence of cases of small-pox in June 1895, that "the causes which produced "this sudden spread of the disease were not far to seek. Of the 35 patients admitted "during June, only six possessed a fixed home. Of the remaining 29, three were "infected in a London infirmary where small-pox had been introduced by some "undiscovered means in May, and seven were infected in another infirmary by the "agency of a vagrant who developed small-pox shortly after his admission there. "The remaining 19 were vagrants who possessed no lodging or no fixed lodging, or "other persons of the lowest class of society, all of them sleeping, when they slept "under a roof at all, in common lodging-houses, Salvation Army shelters, or the like."

M. A. B.
Report for
1895,
p. 152.

255. The experience of Glasgow shows in a striking fashion how influential are hospital isolation and sanitary reform upon the prevalence and mortality of typhus and small-pox, and how relatively slight is the effect of these agencies at present upon whooping-cough and measles.

During the last half century probably no large town has witnessed so great a change in its sanitary condition as Glasgow.

So late as 1842 the condition of its population was reported by Mr. Chadwick to the Poor Law Commissioners to be the worst of any he had seen in any part of Great Britain. Sanitation in the modern sense of the term scarcely existed. Typhus and small-pox epidemics devastated the city. In 1794 the Royal Infirmary was opened, and fever and small-pox were received into its wards, more from philanthropic motives than from any preventive intention. In 1862 the first municipal fever hospital was opened, and in 1876 the hospital treatment of infectious diseases passed wholly into the hands of the municipal authority, while hospital accommodation was made available for all classes in 1881. Meanwhile a City Improvement Act, and, in 1867, the Scotch Public Health Act had been passed, and in 1870 the first sanitary inspector was appointed. Since then extensive improvement schemes have been carried out, and municipal lodging houses and a municipal washing and disinfecting establishment erected.

The vital statistics bear testimony to the effect of these reforms.

DEATHS per 1,000 from :—

—	All Causes.	Zymotics.
1855–64	30·0	7·8
1865–74	30·5	7·3
1875–84	26·8	5·0
1885–94	23·1	3·8

256. No diseases have shown so remarkable a decline during the period under review as typhus and small-pox have done. Their parallelism is best seen in the two accompanying tables taken from a report of Dr. Russell, the able Medical Officer of Health for Glasgow.

Evolution of
Public
Health administration.
Glasgow,
1895.

GLASGOW—Deaths and Death-rates per Million from TYPHUS for 40 Years (1855–94), showing Number and Per-centage which took place in Hospital for 30 Years (1865–94).

Year.	Deaths.		Death Rate per Million.	Per-centage of Total Deaths in Hospital.*
	Total.	In Hospital.		
1855	460	—	1,291	—
1856	439	—	1,211	—
1857	549	—	1,487	—
1858	504	—	1,340	—
1859	381	—	995	—
1860	408	—	1,047	—
1861	475	—	1,194	—
1862	533	—	1,313	—
1863	671	—	1,621	—
1864	1,138	—	2,705	—
1865	1,177	612	2,749	52·0
1866	596	273	1,361	45·8
1867	497	219	1,112	44·1
1868	367	184	806	50·1
1869	970	507	2,089	52·3
1870	544	282	1,154	51·8
1871	284	117	577	41·2
1872	182	90	368	49·5
1873	68	35	136	51·5
1874	113	59	227	52·2
1875	96	51	192	53·1
1876	92	61	183	66·3
1877	70	52	139	74·3
1878	39	33	77	84·6
1879	55	45	108	81·8
1880	39	28	77	71·8
1881	48	37	94	77·1
1882	31	26	60	83·9
1883	50	36	96	72·0
1884	26	22	49	84·6
1885	15	11	28	73·3
1886	24	20	44	83·6*
1887	20	17	37	85·0
1888	22	17	40	77·3
1889	16	12	29	75·0
1890	14	12	25	85·7
1891	27	27	47	100·0
1892	10	9	15	90·0
1893	10	9	15	90·0
1894	9	9	13	100·0

GLASGOW—Deaths and Death Rates per Million from SMALL-POX for 40 Years (1855–94), showing Number and Per-centage which took place in Hospital for 30 Years (1865–94).

Year.	Deaths.		Death Rate per Million.	Per-centage of Total Deaths in Hospital.
	Total.	In Hospital.		
1855	203	—	570	—
1856	127	—	350	—
1857	399	—	1,080	—
1858	113	—	300	—
1859	201	—	525	—
1860	347	—	890	—
1861	131	—	329	—
1862	27	—	67	—
1863	349	—	843	—
1864	300	—	713	—
1865	26	3	60	11·5
1866	104	17	237	16·3
1867	32	5	72	15·6
1868	3	—	7	—
1869	2	—	4	—

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* The above per-centages are as given by Dr. Russell. On the basis of the figures given in the second and third columns the per-centage for the year 1886 is 83·3.

Year.	Deaths.		Death Rate per Million.	Per-centage of Total Deaths in Hospital.*
	Total.	In Hospital.		
1870	25	4	53	22·2*
1871	184	89	374	43·4*
1872	149	92	301	67·2*
1873	228	170	461	76·2*
1874	214	163	429	73·8*
1875	2	—	4	—
1876	8	6	16	85·7*
1877	13	10	26	90·9*
1878	2	—	4	—
1879	—	—	—	—
1880	2	2	4	100·0
1881	2	1	4	50·0
1882	—	—	—	—
1883	7	5	13	83·3*
1884	11	10	21	83·3*
1885	6	6	11	100·0
1886	2	2	4	100·0
1887	—	—	—	—
1888	—	—	—	—
1889	—	—	—	—
1890	—	—	—	—
1891	—	—	—	—
1892	6	5	9	83·3
1893	26	24	39	92·3
1894	5	5	7	100·0

257. Grouping the figures for small-pox into quinquennia Dr. Russell obtains the following figures :—

——	Total Number of Small-pox Deaths.	Number of Deaths in Hospital.	Death Rate per Million.	Per Cent. of Total Deaths in Hospital.*
1855–59	1,043	—	565	—
1860–64	1,154	—	568	—
1865–69	167	25	76	15
1870–74	804	518	324	65*
1875–79	22	16	10	73
1880–84	22	18	8	82
1885–89	8	8	3	100
1890–94	37	34	11	89*

and he adds, " These results are sufficiently striking without reference to a standard " population. In the 10 pre-sanitation years there were 2,197 deaths from small-pox ; " in the 30 sanitation years 1,060. In the 10 years of imperfect isolation in hospital " there were 971 deaths ; in the 20 years of perfect isolation, 89." Dr. Russell holds that " prevention is the aim and the *raison d'être* of hospitals and sanitary organisation, " and the evidence of the success of prevention, in so far as isolation is concerned, is " and may be formulated as an increasing proportion isolated of a diminishing total " quantity of disease existing."

258. While sanitary reform has been so strikingly successful in the case of typhus and small-pox, measles and whooping-cough show a steady persistency. " The preventive " utility of hospital isolation in the case of measles and whooping-cough is limited by " various circumstances." Dr. Russell finds " the preventive results of the isolation " of measles in hospital are in any case small," and the same seems to be largely true of whooping-cough. " Taking the last five years, after sanitation has done its best, " whooping-cough is still left in the position of the most fatal disease, with a mor- " tality of 979, but now very closely followed by measles, 941."

DEATH RATES PER MILLION FROM :—

——	1855–94.	1890–94.
Whooping-cough - -	1,350	979
Measles - - -	796	941

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* The above per-centages are as given by Dr. Russell. On the basis of the figures given in the second and third columns the per-centages for the following years are :—1870, 16·0 ; 1871, 48·4 ; 1872, 61·7 ; 1873, 74·6 ; 1874, 76·2 ; 1876, 75·0 ; 1877, 77·0 ; 1883, 71·4 ; and 1884, 90·9. And for the quinquennia 1870–74 and 1890–94, they are 64 and 92 respectively.

259. At Warrington, where in 1892–3, according to Dr. Savill, the Vaccination Acts had been so thoroughly carried out that more than 99 per cent. of the people, according to his census, are vaccinated, the want of proper isolation accommodation was held accountable for the extent of the epidemic. Dr. Savill says :—" It will be gathered from " the foregoing narrative that insufficient or imperfect isolation was an extremely important factor in the causation of the Warrington small-pox epidemic 1892–3. This " was owing partly, in some instances at the commencement, to a non-recognition of " the cases; but it was due chiefly to an absence of hospital accommodation sufficient " for the reception and isolation of the patients as soon as they were attacked and " identified.

" The sanitary authority had neglected to act on the recommendations of their " medical officer of health in this matter of hospital provision. The purchase of " additional land for that purpose was contemplated in the summer of 1890, but it was " not carried out until October 1892.

" It is rendered evident from a close examination of the facts of the epidemic that if " the town of Warrington had possessed adequate hospital accommodation for " infectious disease the epidemic would probably never have reached the dimensions " it did, and the disease would in all probability have been limited to a few cases in " certain quarters of the town."

Warrington obtained notification by a Private Act in 1879, and in the epidemic of 1892–3 only 16 cases out of the 667 escaped notification.

At the commencement of the epidemic the total provision for the hospital isolation of infectious diseases was 30 beds, or less than half the very lowest estimate of that required. As a consequence of this only 13 cases could be received into the Borough Fever Hospital by dangerously overcrowding every available space.

The hospital is situated in a rather thickly-populated part of the town.

It appears that an outbreak of small-pox in May 1892 (consisting of three imported cases and one secondary case) was effectually dealt with by isolation, disinfection, and quarantine; but on the 18th of the same month the medical officer of health reported to the sanitary authority that " up to the present time we have been able to cope with " introduced cases notified from the borough, but, as I pointed out in February 1889, " there is very great danger in treating small-pox cases in close proximity with " a populous neighbourhood as Aikin Street is, and two full wards of scarlet fever in " our own grounds."

It was not, however, until the epidemic had established itself in the town that additional accommodation was provided in September 1892, at some disused Iron Works in Dallam Lane. These were situated near the northern fringe of the populated part of the town, but there appears to have been ample opportunity for communication with the outside world, at any rate, during the height of the epidemic.

Owing to deficient hospital accommodation, 91 cases were left at home, either altogether, or for periods varying from two to 22 days after the appearance of the rash. The limit of hospital accommodation was twice reached, viz., on August 23rd, when the old hospital became full, and on November 12, when the new hospital was also full. Dr. Savill traces 308 and 102 cases respectively to lack of hospital accommodation at these periods of arrest of removal. The spread of the disease within the hospital and workhouse are also attributed to insufficient isolation and overcrowding.

In the preliminary outbreak in May 1892 the whole family was quarantined, and this may be the reason why this outbreak spread no further. With this exception, no measures for the actual removal and isolation of the healthy members of an infected household were adopted in the case of the Warrington outbreak, and though persons were enjoined to avoid contact with the infected, there is reason for thinking little care was exercised in this respect, and no efforts at regular daily inspection and supervision, such as those adopted at Leicester, appear to have been made.

In view of the limited provision for isolation, we agree with Dr. Savill, that " it is " not to be wondered at that on this account the small-pox epidemic of 1892–93 " reached the alarming proportions which it did."

260. The facts in regard to the methods adopted at Leicester and Sheffield will be found in sections 480–487 of the Report.

261. In regard to Gloucester, although we have not yet received the complete report of Dr. Coupland, we learn from him that the following circumstances contributed to the extension of the disease :—

1. " A main factor was the introduction of the disease into some of the public " elementary schools."

2. The large and increasing proportion of cases retained at home; especially as "quarantine," which in the early periods was under supervision, came to be more a matter of advice than of control. Dr. Coupland believes that "the facilities of "intercourse between neighbours will account for a great deal—in other words, "the failure of isolation."
3. The hospital is situate within the city and was crowded to excess, there being at one time two and even four in a bed; it is possible that the hospital contributed to the spread, but it is difficult to prove this. On the other hand "there had been "aroused a deep feeling against the hospital; the mortality amongst the children "admitted into it had been very high, and this feeling could not be eradicated, "although the accommodation was extended and the organisation improved. "Thus it happened that the majority of persons remained in their homes up to "the last weeks."
4. The small sanitary staff was overtaxed; and Dr. Coupland reports there were serious defects in hospital administration.
5. The hospital accommodation was afterwards increased and the administration improved; that these efforts were not more immediately successful was owing to the unwillingness of the people to enter the hospital which had so suffered in reputation.
6. Dr. Coupland, in comparing the experience of Gloucester with that of Leicester, points out that Leicester has the advantage of being better organised in its Sanitary Department, and its Medical Officer is not, as at Gloucester, engaged in private practice. There is more "sanitary vigilance" at Leicester and its sanitary staff is more numerous.

262. It is evident from the experience of Sheffield and Warrington that the most thorough carrying out of the vaccination laws will not prevent serious epidemics of small-pox, and that well-vaccinated towns cannot afford to neglect the provision of hospital isolation in order to prevent small-pox running riot in their midst.

263. The evidence leads us irresistibly to the conclusion that the simplest and most successful method of limiting and stamping out small-pox outbreaks is and always has been to separate the diseased from the healthy, and to disinfect infected places, things, and persons.

264. In so far as this is practised small-pox is restricted and extinguished, in so far as this is neglected it tends to prevail, *i.e.*, to become epidemic.

265. The principle to aim at, then, is that of universal exclusion from opportunity of infection. It is the opposite of the principle underlying the practice of inoculation, which is that of universal acceptance of the disease and its artificial "sowing" or "buying."

266. The method of isolation or exclusion, although it had been suggested by a few, had not received much attention until after inoculation and vaccination had been tried, without achieving that success which it had been confidently hoped and asserted by the advocates of each was likely to result therefrom.

267. The history of dealing with small-pox, where it has been a matter of any concern, has been the history of passage from superstitious fatalism, or passive indifference, through the paralysing acceptance of "epidemic constitution" as the all-sufficient explanation, to active attempts, by inoculation or vaccination, to anticipate the disease.

268. During the practice of these latter methods, and side by side with them, there has gradually grown up a mass of evidence proving the efficacy of early isolation of notified cases of small-pox, disinfection, and quarantine, in controlling outbreaks.

269. There is also evidence showing that certain countries, by virtue of their geographical isolation, have enjoyed practical immunity from small-pox. The experience of places so dissimilar as the Continent of Australia, the town of Leicester, and the County of London shows that, even with a considerable and increasing number of unvaccinated persons, an isolation system may be carried out with remarkable success.

270. Infantile vaccination as now enforced in the United Kingdom does not prevent epidemics. 1770. 2988.

271. Notification and isolation appear to be accepted even in places where the greatest hostility to vaccination has been manifested. 5833. 5820.

272. Those who trust to vaccination say:—Vaccinate your child before it is three months old, and so render it less liable to have small-pox badly if it should happen at some future date to come in the way of it. Those who trust to isolation say:—Small-pox is notified to be here, now. Let the healthy be separated from the sick, let the latter be isolated at home, or, if they cannot be properly attended to there, let them be

removed to a suitably isolated hospital. There can be no doubt that the latter is the stronger position of the two; and in practice it has been found to secure the intelligent co-operation of the public.

273. In accordance with the sub-head No. 2 of the reference to the Commission, we would suggest the following as the means other than vaccination which should be employed for protection of a community from small-pox:—

1. Prompt notification of any illness suspected to be small-pox. Improved instruction in the diagnosis of small-pox.
2. A hospital, suitably isolated, of adequate accommodation, in permanent readiness, and capable of extension if required. No other disease to be treated at the same time in the same place.
3. A vigilant sanitary staff ready to deal promptly with first cases, and if necessary to make a house-to-house inspection. The medical officer of health to receive such remuneration as to render him independent of private practice.
4. Prompt removal to hospital by special ambulance of all cases which cannot be properly isolated at home. Telephonic communication between Health Office and hospital.
5. Destruction of infected clothing and bedding, and thorough disinfection of room or house immediately after removal of the patient.
6. Daily observation (including, where possible, taking the temperature and inspection for rash) of all persons who have been in close contact with the patient during his illness; such supervision to be carried out either in quarantine stations (away from the hospital) or at their own homes.
7. Closure of schools on the occasion of the occurrence of small-pox among the scholars or teachers.
8. Hospitals and quarantine stations to be comfortable and attractive, and so administered as to secure the confidence of the public. Hospital treatment to be free to all classes, and compensation to be paid to those detained or otherwise inconvenienced in the public interest, at the public expense.
9. Tramps entering casual wards to be medically inspected, their clothing to be disinfected, and bath provided. The measures for detection and isolation of small-pox in common lodging-houses suggested in section 507 of the Report to be carried out.
10. International notification of the presence of small-pox, and special vigilance at sea-ports in communication with infected places, after the plan adopted in the case of cholera.
11. Attention to general sanitation—prevention of overcrowding, abundant water supply, and frequent removal of refuse.

Reference V.—Alterations in the provisions of the Vaccination Acts with respect to Prosecutions for non-compliance with the Law.

274. It must be obvious from what has been already said that we necessarily consider the legal enforcement of vaccination as inexpedient and unjust. We see no sufficient reason for withdrawing this particular medical prescription from the personal option which attaches to all other medical prescriptions or surgical operations; we do not think that medical authority or advice is likely to gain in confidence or respect, by the adventitious aid of the police, and fine and imprisonment. But even if vaccination were a more effective and trustworthy prophylactic than we hold it to be, we should still think the continuance of compulsion at the present time to be an anachronism. The Final Report of the majority of our colleagues appears to us to show this conclusively. The view there expressed of the value of vaccination differs very considerably from the opinion prevalent in and before 1853, the date of the first compulsory law. Whether such limited and conditional confidence in vaccination as is expressed in the report of the majority would have been held by the Parliament of 1853 to justify compulsion is of course a matter of opinion; but when we recall the unqualified assurances then given that universal efficient vaccination would secure universal immunity from small-pox, we must say, in our opinion, it would not.

275. Our inquiry has shown that medical opinion as to the degree of immunity afforded by efficient primary vaccination has been modified since 1853, the date of the first compulsory Vaccination Act. At that time the Epidemiological Society used its influence to get the Act passed on the ground that the whole medical profession was agreed on the certain efficacy of vaccination as a preventive. The evidence we have received shows that this agreement no longer exists. Amongst the professional witnesses who have favoured us with their views there are marked

685.
1755–71.
12,919,

differences of opinion as to the length of the period during which primary vaccination 1755.
is effective. But not one of them has maintained Jenner's first claim that vaccination conferred a lifelong protection.

276. It is apparent from the history of legislation on this subject that the assumption 12,913–22.
underlying every amendment of the law was a strong and general belief that, if only the absolute universality of efficient primary vaccination could be secured, epidemics would be prevented, and practical immunity would be secured for the whole population
throughout life. On the other hand we have it in evidence that the epidemic of 685.
1871–3 was as severe and widespread as any experienced during this century, and that in the course of this epidemic "a very large proportion of the total small-pox deaths "of adults was amongst people who had at some time or other been vaccinated."

277. It would seem, therefore, that there is a certain amount of discrepancy at the present day between the theory on which the compulsory law is based and the actual state both of fact and opinion.

278. Under these circumstances it has been suggested to us that the obvious remedy 100–2, 118,
is to amend the law by making re-vaccination compulsory. But though such a course 156.
might receive a good deal of support from medical opinion, the evidence we have as to 11,635.
the condition of public feeling shows that it would be impracticable.

279. This condition of things can hardly be considered satisfactory. The law as it stands enforces, under penalty of fine or imprisonment, a practice once thought to be an effectual preventive of epidemics, and a practical safeguard for every individual vaccinated. But this prescription of the law is now generally recognised as insufficient unless primary vaccination be supplemented by secondary or repeated vaccination. The question thus arises whether it is just or expedient to enforce at the cost of much local discontent a preventive which does not secure the end proposed, and which confessedly cannot now be supplemented by the only measures which, according to the medical opinions quoted, could make it effective.

280. In support of a continuance and reinforcement of the present law it is urged that if primary vaccination be not an infallible preventive, at least it always lessens the severity of the disease, if caught, and diminishes the mortality. It is, however, doubtful whether such results as these would have been held to justify compulsion when it was first proposed. And we cannot shut our eyes to the fact that this shifting
of the ground of compulsion has reopened the whole question in the minds of many who 18,042–3.
accept this modified view of the Jennerian practice. As Commissioners commanded 13,065.
to consider and report on "provisions of the Vaccination Acts with respect to pro- 13,143.
"secutions for non-compliance with the law," we cannot avoid a reconsideration of this issue, which has very much to do with the unsettlement of public opinion on the Acts in question.

281. It cannot be denied that the law as it stands is of a very exceptional character. It is the only instance under our Constitution of the universal enforcement by fine and imprisonment of a surgical operation. In all other cases preventive sanitary law affects only outward circumstances, such as light and air, sewerage, overcrowding, public exposure of infected persons, and the like. In all such cases the social interests are so direct and predominant, and the individual claims affected are so slight, or so merely mercenary—as in the case of owners of insanitary premises—that the reasons for compulsion are simple and uncomplicated by any delicate question of personal rights. But compulsory vaccination goes beyond outward circumstances, and invades the integrity of the healthy body. It requires a wound, however slight, to be inflicted on every healthy infant born, and the contraction of a disease, however slight, of the successful cultivation of which the vaccinating surgeon must satisfy himself. The law gives the parent or guardian no option as to incurring the possible dangers of the operation. In all other cases he is allowed to decide on his own responsibility whether he will follow a particular medical prescription or not. But in this he must accept the operation with all its dangers, real or imaginary, at the dictation of the law. He may believe that he has lost previous children through the effects of vaccination. But nevertheless he must run the risk again, or be treated as a criminal. It may fairly be conceded that a compulsory law of this nature requires justification different both in kind and degree from that of laws affecting ordinary nuisances.

282. The case as put before Parliament in 1853 seemed exceedingly strong. But, unfortunately, it did not receive much discussion. It rested, as we have seen, on the practical unanimity of the medical profession in the opinion that universal primary

vaccination would extinguish small-pox. It was argued that the plague of small-pox was such as to justify exceptional measures. It was believed that vaccination had already come into such general vogue that only carelessness accounted for occasional neglect. And, finally, it was assumed that there were no dangers to be feared such as might perplex the consciences of parents.

283. The evidence we have received shows that the same position cannot be held now. Eminent medical men, some of whom have appeared before us, are now maintaining that the protection supposed to be afforded by vaccination, even though repeated, is
11,843. almost entirely illusory. Some allow indeed that the disturbance of the constitution
11,848. set up by vaccinia may during its brief continuance prevent the development of small-pox from inoculation. But in their opinion this protection is so exceedingly brief in
11,855. its duration that it is of no appreciable value as a prophylactic against epidemics. Whether that opinion be scientifically justified or not, the fact that it is held by medical men of great scientific reputation has recently done much to encourage resistance to the law. Where doctors differ it seems difficult to resist the claim of parents to be allowed to choose for themselves which opinion they will follow.

284. In 1853 there were few or no signs of opposition amongst the population when called upon to submit to the law. There was a general acquiescence in the assumption that the abatement of the virulence of small-pox from the commencement of the 19th century had been due almost entirely to the voluntary and partial adoption of vaccination. Those who neglected it were reasonably suspected of doing so, not from any conscientious conviction, but from mere carelessness and indifference to social welfare. It seemed right in the opinion of the time, therefore, that they should be compelled to adopt an apparently harmless precaution, which was believed only to need universal enforcement to secure the whole nation against a deadly disease. If these anticipations had been realised there seems no reason to doubt that the law would have continued to be enforced with little or no friction.

285. But in no year after the enactment of compulsion was the number of deaths reduced below 1,500 until the year 1875. It was during the eighth decade of this century that resistance to the law began to spread widely; and the main point on which recalcitrants insisted was that experience proved the impotence of vaccination to prevent epidemics.

286. The case of Leicester, on which we have had a large amount of evidence, illustrates most clearly the origin and growth of local resistance to the law. It is proved that down to 1872 Leicester was, what is usually considered, a well-vaccinated town. During the years immediately preceding that date not more than 5 per cent. of the children born in each year were "unaccounted for." In other words, 95 per cent. were reported as satisfactorily vaccinated. In 1871, the year of the worst epidemic during the present century, the condition of Leicester was exceptionally good. Out of the whole 4,446 children born there in that year, only 15 were found to be neglected, and in every one of these 15 cases the parents were prosecuted, It appears, therefore, that there was very little, if any, opposition to the law in Leicester at that time, and public opinion in its favour seemed to be confirmed by experience; indeed the Medical Officer of Health of the borough, in his reports for the years 1869 and 1870, was able to state that vaccination had been "sedulously attended to," and he claimed the immunity of the town from small-pox as evidence of the effect of vaccination. While the epidemic in the country at large carried off 23,126 people in 1871, Leicester only lost 12. But in 1872 the town was not so fortunate. The deaths from small-pox suddenly rose to 346.

287. According to the evidence we have received, it was experience of this epidemic that fostered the rapid growth of opinion in Leicester adverse to vaccination. The ground taken was that vaccination had not protected either the population at large or the individuals vaccinated, and that therefore it ought no longer to be enforced. There were other reasons, such as the growth of a belief that the operation is injurious and sometimes fatal. But the origin of the movement was the disbelief in vaccination as a prophylactic. The election in 1887 of a board of guardians, of whom a majority were opposed to compulsion, led to the entire abandonment of prosecutions, and the law has since that time been locally in abeyance. Experience of a more recent outbreak in 1893–4 has not changed local opinion. On the contrary, it is alleged that the cessation of vaccination, together with the adoption of sanitary and isolation measures (to which we have referred in a former part of this report), have been much more

effective in saving life than was the enforcement of the law at the period of the previous epidemic.

288. The prevalence of this opinion is by no means confined to Leicester. In December 1891 we issued to all boards of guardians in England and Wales a number of questions concerning their mode of carrying out the law, the enforcement of which rests with them. The replies showed that in 122 unions compulsion had either been temporarily suspended until the report of the present Commission, or had been entirely abandoned, independently of our inquiry. These unions include, in addition to Leicester, a number of important towns, such as Reading, Falmouth, Derby, Darlington, Gateshead, South Shields, Colchester, Westham, Gloucester, Burnley, Bury, Oldham, Lancaster, Wigan, Wolverhampton, Ipswich, Eastbourne, Coventry, Hull, York, Middlesboro', Scarborough, Bradford, Dewsbury, Halifax, Keighley, and others.

289. The law is also in abeyance by resolution of the guardians, in the following Metropolitan Unions, viz., Camberwell, Hackney, Islington, Lambeth, Mile End, St. Olave's, St. Saviour's, and Shoreditch. Making allowance for the fact that in about 46 of the 122 unions the suspension of the compulsory law is professedly only temporary until this Commission shall have reported, we cannot regard without anxiety and fear the painful conflict that would be inevitable if an attempt were made to revive and re-enforce the compulsory law in these localities against the prevalent opinion of the inhabitants.

290. Indeed, even to make the attempt would be impossible without a considerable change in the law. For at present the duty of enforcement lies with the guardians, and it is made a test question in their election. If we could suppose that the evidence laid before us would have the effect of changing local opinion, we might count on the future election of guardians willing to carry out the law. But a large part of that evidence has been published already, and there is hitherto no appearance whatever of any change in the local opinion of the unions above mentioned, except in the rare cases in which epidemic has occasioned panic. Each year of our labours has witnessed not an increase, but a decrease in the numbers of guardians elected in these unions by the supporters of compulsion.

291. It appears, therefore, that, if the present law is to be made really effective, this can only be secured by imposing the duty of its enforcement on the police under the direction of inspectors of the Local Government Board. There is too much reason, however, to fear that even this would not be sufficient without a material increase in the severity of the law. The evidence received as to the prevalence and strength of 6052-6764.
conscientious objections on the part of parents convinces us that a considerable number could not be compelled by any penalties of fine or imprisonment to bring their children for vaccination or to allow the operation at their own homes. People who show this spirit are considered martyrs by their neighbours, and a few such cases soon create a local agitation against the law. The only way of enforcing the law without prosecution of parents would be to empower public vaccinators to seize children by the aid of the police and vaccinate them by force. But the attempt would probably create an agitation such as no Government could withstand.

292. The difficulty of compulsion is greatly enhanced by the undeniable fact that vaccination is attended by an appreciable amount of danger. The constitution of a child is always more or less disturbed by it; and though the number of cases in which this disturbance assumes a painful or fatal form bears small proportion to the number of infants vaccinated, yet a certain amount of risk remains undeniable: and the question whether this risk should be encountered or not is naturally regarded as a matter of parental responsibility. We are unable to report that this risk is infinitesimal or unimportant.

293. The degree of risk which parental feeling may justly be compelled to encounter is scarcely susceptible of statistical statement, If we were in a position to affirm that there is absolutely no danger, our task might be much simplified. But when once the reality of appreciable danger is proved, as we hold it to be, it becomes a very delicate question how far the law is morally justified in interfering with the discretion of parents. It may be urged that a very great danger to the community might justify the enforcement of a proved and indispensable safeguard even at some risk to individuals. But the danger from small-pox to any community using such precautions as we have recommended is not now great enough, nor is the safeguard of sufficient certainty to fulfil these conditions.

294. It is true that in a considerable number of the cases examined for us the injury or death is reported to have been only indirectly due to vaccination. Insanitary surroundings and parental ignorance or even parental neglect are assigned in some cases as the causes of complications. But even in such cases it is clear that, apart from the vaccination, the contributory causes alone would not have produced the results admitted. An operation which for its safety requires complete sanitation, with care and skill on the aprt of every mother, would seem to be scarcely a fit matter for universal compulsion.

295. On this point we may quote the language of M. Depaul, for some time superintendent of the vaccination service in France, as reported and approved by the late M. Lefort, himself a strong advocate of vaccination but an opponent of compulsion. In his final reply on a long discussion in the Académie de Médecine, M. Lefort said: " A law to make vaccination compulsory seems to me vexatious, ineffective, and " impracticable. I cannot put out of my mind the offensiveness of such a law to " free men; nor can I any more put out of my mind that the father of a family also " has rights of which he can hardly be disposed to deprive himself in order to entrust " them to the Government. Still, if we could—not indeed entirely suppress small-pox— " but at least diminish it substantially by violating this liberty, I could even assent to " this notwithstanding my repugnance; but as it is not so I cannot assent to this " compulsion." " Here, gentlemen, it is not I who speak, but it is M. Depaul, for long " the director of our vaccine service, who uttered these words on this platform on " March 20th, 1881." (Bulletin de l'Académie de Médecine, 3me série, Tom. xxv, No. 7, séance du 17 Février 1891, p. 270.)

296. On the whole, then, we are of opinion that a resolute and universal enforcement of vaccination is neither possible, nor expedient, nor just. It is not possible, because there exists a sufficient amount of conscientious opinion opposed to it to give recalcitrants the credit of martyrdom, and because in great centres, such as Leicester, it is questionable whether even the police could carry out compulsion without the aid of the army. It is inexpedient, because it concentrates attention on a safeguard proved to be insufficient in itself, and leads to the neglect of sanitation and isolation, which our evidence shows to be more effective. It is unjust, because to meet a danger often remote by a defence at best uncertain, it overrides parental responsibility and disregards parental feeling.

297. The proposal of our colleagues is, that, while abandoning the attempt to enforce vaccination upon those who honestly object to it, we should continue to press it by force of law upon the indifferent and negligent. In the matter of re-vaccination, however, their proposal is different; they are impressed with the transient influence of vaccination, and recognise the need of re-vaccination as early as nine or ten years of age, and advise its repetition at intervals, but they do not suggest that the repeated operation, which they regard as essential, should be pressed upon the indifferent and negligent as in the case of the primary operation.

298. Now the whole principle of securing the protection of a community from small-pox by the artificial production of a mild disease (whether it be inoculation or vaccination) is based upon the thoroughness of the procedure in two directions:—1. In applying the inoculatory process to *every* individual; and 2. In securing to each individual operated upon the maximum of protection the process is capable of securing.

299. The proposals of our colleagues appear to us to fail upon their own showing in both directions. They recognise the impossibility of securing the primary vaccination of every person, and open a means of escape for objectors. They are also not prepared to recommend that re-vaccination should be pressed in the same manner as the primary operation at a time when the vaccinated have lapsed into susceptibility to small-pox.

This serves to prove that any such system must at best be a broken reed on which to rely for the protection of a community from small-pox epidemics.

300. We believe the methods of isolation of the infected, disinfection and the observance of strict cleanliness are both more successful and more legitimate methods for the State to encourage. They have the advantage of applying the preventive only where it is required: and they do not necessitate an operation upon the person of every healthy individual.

301. We, therefore, recommend that the law be amended by the repeal of the compulsory clauses of the Vaccination Acts. But in consideration of the prevalent belief in the value of vaccination as a prophylactic for an indefinite period, we suggest that in other

respects the law should be left as it is, subject, however, to such modifications as are recommended for the diminution of attendant risks. The precedent established in the case of the abolition of compulsory church rates might be followed with advantage. In that case all machinery for laying and collecting the rate was left intact though the power of enforcement was taken away. The effect of our recommendation, if adopted, would be that vaccination would continue to be provided as at present for those who desire to avail themselves of it, but efforts to secure vaccination would be limited to moral influence—in a word, the whole country would be in the position of those unions in which the guardians have abandoned compulsion.

302. The grounds on which we object to the enforcement of vaccination by penalties necessarily lead us also to object to any method of indirect compulsion. We regard as both inexpedient and unjust exclusion from any branch of the public service because of the refusal to submit to vaccination or re-vaccination. The injustice is perhaps most severely felt in the case of candidates for employment as pupil-teachers in public elementary schools. There are now districts in which, owing to the general opposition to vaccination, scarcely a girl or boy can be found who is legally eligible, and candidates have to be brought in at great inconvenience from surrounding districts. The existence of an exceptional case or cases in which such rejected candidates have at some time afterwards taken small-pox is in our view no justification for the continuation of this grievance. Statistics furnished to the Commission prove that large numbers of vaccinated or re-vaccinated persons have taken the disease; and we are not aware of any evidence to show that vaccinated pupil-teachers have any special immunity. If our recommendations were carried out the danger of contagion would be greatly diminished, in schools, as elsewhere.

303. On the whole, then, while there is much in the report of our colleagues from which we dissent, and we have accordingly abstained with reluctance from adding our signatures to theirs, we are at one with them in holding that it is unwise to attempt to enforce vaccination on those who regard it as useless and dangerous. We, however, go further, and agree with our colleagues, Mr. Whitbread and Mr. Bright, that it would be simpler and more logical to abolish compulsory vaccination altogether.

W. J. COLLINS.
J. ALLANSON PICTON.

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ROYAL COMMISSION ON VACCINATION, 1889-96.

FINAL REPORT.

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(Pages 1 to 141 inclusive).

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RECOMMENDATIONS AND SUGGESTIONS OF COMMISSION:
- Age:
  - (*a.*) *For Primary Vaccination:*
    - Would be well to extend it to six months, or to one year from the date of birth, but this only if the vaccination of all unvaccinated infants be secured whenever a case of small-pox occurs in a sanitary district, 438, 440.
    - Vaccination of infants in workhouse-infirmaries and lying-in hospitals within a few days of birth should be deprecated, unless there be obvious danger of small-pox contagion. Even so, the infant should, if possible, be kept under observation until the arm is healed, and in such cases only one insertion of vaccine should be made, 441.
  - (*b.*) *For Re-vaccination:*
    - Parents should be impressed with the importance of re-vaccination of children at not later than 12 years of age, 533.
- Ambulance Arrangements in relation with small-pox hospitals should be organised with scrupulous care, 499.
- Calf Lymph:
  - Absolute immunity from risks of syphilis only possible by use of calf lymph, 430, 437.
  - Risk of conveyed leprosy may be wholly got rid of only by use of calf lymph, 431.
  - No requirement of vaccination should be made apart from use of calf lymph. So long as compulsory vaccination remains law, and while vaccination entails the expenditure of public money, the means of obtaining calf lymph should be placed within the reach of all; and steps should be taken to secure this, 437.

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  - Repeated penalties should no longer be enforced, 511.
  - Persons committed to prison for non-payment of penalties should cease to be treated as criminals, 535.
  - Devolution of duty of procedure in cases of default on Local Government Board in place of local authorities not practicable, 515.
  - Compulsion of parents honestly opposed to vaccination to be deprecated, 524.
  - Statement of objection to the satisfaction of local authority, or statutory declaration before a competent official might be made a bar to proceedings, in all parts of the United Kingdom, such change of practice being made experimentally in first instance, say, for five years, under close watch of results attained, 525, 526, 527.
  - Defaulters should be sought out at their own homes, and then and there vaccinated, unless opposition be made, or postponement seem desirable, 529.
  - When default has arisen, by reason of non-receipt of a certificate of vaccination of a child within a specified time, notice should be served upon the parent that attendance will be given on a named date at his house for the purpose of vaccinating the child in question, unless meanwhile vaccinated; and offence against the law will arise on refusal of parent to allow the vaccination to be then performed, 529.
  - Both vaccination and inspection should take place at home, 529.
- Disease: Precautions Against.
  - Where humanised lymph is used, lymph from inflamed arms should be avoided, 410.
  - Rejection of infants under 4 months of age and of all adults as vaccinifers recommended, as probably removing all chance of invaccinated syphilis, 430.
  - But use of calf lymph alone can be looked to as wholly removing risk of syphilis, as also of leprosy, 430, 431, 433, 437.
  - Vaccination and inspection of results should take place at child's home, as tending to diminish risk of disease at public station, 414.
  - All vaccinating instruments should be boiled or otherwise sterilised, simple instruments preferred, 449.
  - Vaccine insertions should not be too close together, 449.
- Disease Prevention as regards Common Lodging-houses, Shelters, and Casual Wards.
  - All common shelters should be made subject to the law regulating common lodging-houses, 507 (i.).
  - Local authorities should have power:
    - To require medical examination of entrants to common lodging-houses and casual wards, and to offer rewards for prompt information as to presence of small-pox therein, 507 (ii.).
    - To order keeper of common lodging-house to refuse fresh admissions during a specified time after known existence of small-pox therein, 507 (iii.).
    - And to require temporary closing of any such house, 507 (iv.).
    - And to offer free lodgings to persons in common lodging-house or casual ward suspected of capability to spread small-pox, 507 (v).
  - Notice should be given to all adjoining sanitary authorities of occurrence of small-pox in such places, 507 (vi).
  - The Public Vaccinator or Medical Officer of Health should attend and vaccinate all willing inmates of such infected places, 507 (vii).
- Domiciliary Vaccination:
  - Would diminish chance of disease at public station, and of injury to children, 414, 443, 445.

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Humanised Lymph:
- Use not to be precluded, 437.
- None should be taken from inflamed arms, 410.
- Nor from infants under 4 months of age, nor from adults, because of chance of invaccinating syphilis, 430.

Inspection of Vaccination:
- To be during some day of second week after vaccination, in place of eighth day as now, with further obligatory inspection in the third week, 450.

Isolation of Small-pox:
- No considerable number of patients should be kept in a hospital situate in a populous neighbourhood, 499.
- Steps should be taken to secure more general provision of means of isolation than at present exists, and all sites should have space available for temporary additions, 504.
- Adequate hospital accommodation should always be in readiness for the reception of all cases, 501.
- The Local Government Board should be empowered to make an order for the provision of a hospital whenever satisfied of its necessity after petition by a prescribed number of ratepayers in any district, 505.

Lymph Distribution:
- Lymph should be in tubes; not on "dry points."
- Each tube should contain only sufficient lymph —of whatever sort—for the vaccination of one person, 448.

Notification of Small-pox:
- There should be a complete system of notification of small-pox, of compulsory sort, 499.
- The vaccination authority should always be informed by the local authority of any case of small-pox notified to them, 534.

Payment of Vaccinators:
- The amount of fee to be paid to public vaccinators should adequately cover all such duties as attendance on a vaccinated child called for by some untoward result of vaccination, 450.
- Such attendance should be compulsory on requirement of parent, 532.
- Every medical practitioner should be paid the fees now paid to a public vaccinator in respect of successful vaccinations, where the rules of the Local Government Board have been observed. All vaccinations should be liable to inspection, such inspection, limited generally to a number of test cases, to precede payment of fees, 530.

Postponement of Vaccination:
- Ought to be made when erysipelas, scarlet fever, measles, or chicken-pox prevail near the home or place of vaccination of a child, 445.
- And should be permitted if child's surroundings or other condition render vaccination undesirable, 446.

Re-vaccination:
- Should be repeated once or twice if failure of success follow first or second attempt, as in case of primary vaccination, 302.
- In the case of persons much exposed to small-pox infection, re-vaccination is especially important, and should be repeated for a third and even fourth time if a long interval has elapsed since the last operation, 342.
- Calf lymph in re-vaccination, as in primary vaccination, can alone obviate risk of invaccinated syphilis, 432.
- Re-vaccination should be urged at not later than 12 years of age, 533.

State Vaccination:
- So long as compulsory vaccination obtains, or public money is expended on vaccination, the State should place within the reach of all the means of obtaining calf lymph, 437, 531.
- The State should continue to promote the vaccination of the people, 509.

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State Vaccination—*cont.*
- The Commission cannot recommend trust in voluntary as opposed to requirement of vaccination, 509.
- No consideration of cost should stand in the way of improvement or smooth working of the law or the avoidance of risk, 532.
- *See also under* Payment of Vaccinators, 530.

Supervision, &c. of Suspected Persons:
- There would be advantage in a careful supervision, and, if possible, in isolation for 16 days of all persons who have been in contact with small-pox patients, 499.
- *Compulsory* removal to quarantine for 21 days of all persons in infected house would be of the highest efficacy. Insuperable difficulties are acknowledged, 500.
- Power to compensate for loss of wages, &c., in the case of isolated patients or of suspected persons placed under supervision and so forth, should be given to local authorities, 506.

Treatment of Vaccinated Persons:
- Foreign substances should not be rubbed into vaccination wounds, 442.
- Materials applied to the vesicles should be scrupulously clean, 442.
- Public warnings should be given on such points, 442.
- The Local Government Board should promulgate rules for the proper care of vaccinated arms, 442.
- It is desirable that a child be removed from surroundings calculated to cause risk during the course of vaccinia, 446.
- Vesicles should not be opened except for adequate reason, 447.
- Unfavourable symptoms supervening upon vaccination should claim the vaccinator's attention, 450, 532.

Vaccination Authority:
- Any feasible amalgamation, or any steps towards such amalgamation, of vaccination and sanitary authorities would be regarded favourably by the Commission. Point discussed, 508.

Warnings to Public:
- Urgency of vaccination and re-vaccination and of avoidance of all risk of infection should be impressed upon the public by local authorities whenever small-pox shows a tendency to epidemicity, 534.

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VACCINATION COMMISSION.

APPENDIX III.

TO THE

FINAL REPORT

OF THE

ROYAL COMMISSION ON VACCINATION.

REPORT TO THE COMMISSION OF

DR. SYDNEY COUPLAND

ON THE OUTBREAK OF SMALL-POX IN THE DEWSBURY UNION IN 1891-2.

Presented to both Houses of Parliament by Command of Her Majesty.

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Report of Dr. Sidney Coupland on the Outbreak of Small-pox in the Dewsbury Union in 1891–2.

CONTENTS.

Introduction.

Part I.—General account of the district as regards area, population, zymotic history, sanitary administration, notification, isolation, and vaccination.

Part II.—Small-pox in 1891–2 : *a general analysis of the whole outbreak.*

Part III.—Small-pox in 1891–2 : *history of the epidemic in the various districts of the Union and analysis of the leading facts of its incidence in Batley, Dewsbury, and the other districts of the Dewsbury Union.*

Part IV.—Vaccination in relation to small-pox in this epidemic.

INTRODUCTION.

During the year 1891 small-pox prevailed in certain parts of the West Riding of Yorkshire, especially in the districts of the Dewsbury Union. The outbreak increased in severity at the beginning of 1892, and in compliance with instructions received from the Chairman of the Royal Commission on Vaccination I proceeded to Leeds on March 31st, 1892, to institute an inquiry into its course and extent.

I desire at the outset to express my warm thanks to Dr. Whitelegge, the Medical Officer to the West Riding County Council, for his valuable advice and assistance in initiating the inquiry, which did so much to facilitate a task somewhat foreign to my usual avocations. I also lost no time in putting myself into communication with the local authorities and the medical officers of the Dewsbury Registration District, who cordially gave me every information and assistance. I learnt that the epidemic, which had been of considerable proportions, was then apparently declining, and that the inquiry would embrace an extended personal investigation if it were to any degree to fulfil the objects aimed at. The plan entailed a personal house-to-house visitation of every dwelling of which one or more inmates had suffered from the disease, and it soon became evident that to have attempted this single-handed would have involved a very great expenditure of time. Accordingly I applied to the Chairman of the Royal Commission for permission to have the co-operation of Mr. E. A. Fardon, the resident medical officer of the Middlesex Hospital, during a part at least of the inquiry. That permission was given, and my thanks are due to the weekly board of the Middlesex Hospital for granting me the use of Mr. Fardon's services. The value of his assistance and counsel at many points cannot be estimated too highly.

Mr. Fardon arrived on April 19th, and from that date until May 7th we were daily engaged in the work of inspection. This work I continued after his departure so as to include all the cases of small-pox arising up to April 30th, the inquiry being so far completed on May 14th.

In the month of August and for a few days in September I again visited the district, and was thereby enabled to include in my returns particulars of every case that had occurred up to August 27th, 1892—the total period covered by the inquiry being 16 months or 70 weeks—the first case having occurred in the week ending May 2nd, 1891.

During this time there were known to have occurred in the Dewsbury Union a total of 1,029 cases of small-pox. This number is inclusive of six cases arising in the Dewsbury Union Workhouse, one in the Dewsbury Infirmary, and one in the Batley Small-pox Hospital. It was found that the 1,021 patients came from 645 houses, and an attempt was made to visit every infected house; but owing to removals or to the absence of the inmates at the date of the visit, it was not possible to procure particulars of every household. Altogether information was gathered from personal visitation of 544 houses, yielding a total of 3,000 inmates, of whom 887 had been attacked with small-pox. Frequent visits were also made to the various hospitals where cases were inspected and other cognate inquiries made.

Definition of terms used.

It may be well if, in this place, I were to briefly explain and define certain terms employed in the text of the report to signify the type of small-pox and the character of vaccination. In few diseases do we have so markedly exhibited gradations in severity as in small-pox. There is the widest possible difference between cases which are characterised by a profuse, confluent rash, severe secondary fever and constitutional disturbance, and those in which the eruption is limited to a few sparse papules, which may never maturate, and where the only constitutional disturbance is a slight initial fever. Yet between these two extremes (not to mention the malignant hæmorrhagic class, which strictly fall into a category of their own) there is every degree of extent of eruption, not always, be it noted, associated with a like severity of febrile disturbance commensurate with the profuseness of the rash. Since, however, the data are not always available for dividing cases of the disease strictly according to their degree of severity as marked by the secondary fever, and its duration, and since also we have in the character and extent of the skin eruption an approximate indication of the severity of attack, I have adopted the terms "mild," "discrete," "coherent," and "confluent" to denote the various types of the disease. Under the head of *mild* are included most, if not all those cases often termed "varioloid," a term I have hesitated to adopt, seeing that, strictly speaking, it implies something different from variola, and have also limited this class to the cases of very sparse eruption and slight general disturbance. Again, of the *discrete* variety the eruption varies from a moderately profuse rash, which may run a mild course to a thickly distributed eruption of papules that maturate freely and leave a certain amount of pitting. It is hardly possible to draw a line between these "severer" discrete cases, and those where the papules are so profuse and contiguous as to be really "*coherent*." Accordingly, whenever I have had evidence that the attack, although "discrete" has been of that severe type, I have grouped it with the "coherent" class. This latter form passes also insensibly into the "*confluent*" type, where, on the face especially, the pustules run together to form more or less extensive irregular areas which become covered by a common crust. I admit that these divisions are arbitrary, but great care has been taken in assigning the cases to each of them. As to the *hæmorrhagic* class, I have for statistical purposes grouped them with the confluent cases.

I may also explain here the phraseology which has been employed with regard to vaccination. In each case of small-pox and for each inmate of an infected house, inquiry was made respecting the date, and when possible also, the character of primary vaccination. In that way five categories were established.

(1.) *The vaccinated.*—In these there was evidence of primary vaccination having been performed, or when ocular inspection was not possible, the statement of the parent or other near relative was accepted. In the persons inspected, notes were made of the character and quality of the vaccination marks. The fact and date of re-vaccination—a rare event—was also noted.

(2.) *Vaccination uncertain or doubtful.*—In this class no information was at all available.

(3.) *Alleged Vaccination.*—This includes those individuals who were said to have been vaccinated, but in whom, on examination, there were no visible "marks" to corroborate the statement. This class may possibly be larger than appears, since some of those included in the first class who were not inspected might have presented the same fact.

(4.) "*Under*" *Vaccination.*—This phrase, which is here used to denote those individuals who, when suffering from small-pox, or when exposed to liability to infection, were undergoing primary vaccination, requires a few words of explanation. In every small-pox epidemic a certain number of hitherto unvaccinated persons are vaccinated on the appearance of small-pox in their dwellings. Should one of these recently-vaccinated persons contract the disease whilst thus undergoing primary vaccination his case would fall into the category here defined. He would be suffering from small-pox whilst "under vaccination," and might be regarded as presenting an instance of concurrent vaccinia and variola. Nevertheless, if the onset of his attack of small-pox is within 14 days of the vaccination the probability is that he was *infected* with variola prior to being inoculated with vaccinia—and with barely an exception that has been so with all the cases of small-pox which are included under this head in this Report. On the other hand, an individual vaccinated for the first time on the occurrence of small-pox in his dwelling, and not himself contracting the disease, would not be considered as being "under vaccination" in the strict sense unless ho were still exposed to liability to infection from the case. It is assumed that on the removal or convalescence of the patient, and disinfection of the house, such liability to infection ceases, and hence the term "under vaccination" as applied to other inmates of the house than those contracting small-pox will apply—

- (*a*) to those vaccinated at any time in the period of treatment of a patient retained at home; or,
- (*b*) to those only who are vaccinated before the removal of the patient to hospital, and the disinfection of the house.

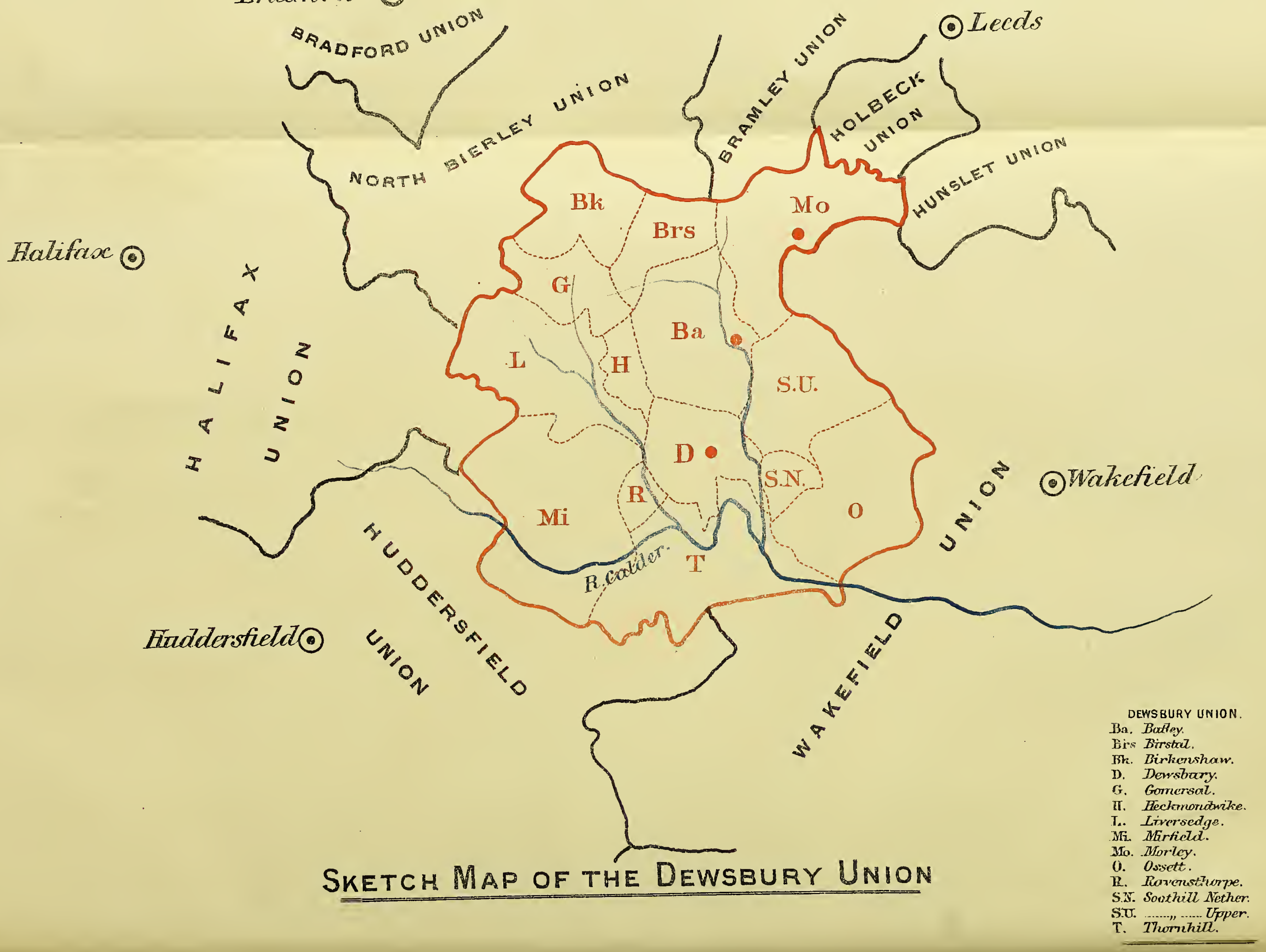
(5.) *The Unvaccinated.*—The source of the evidence necessary to establish a claim to be included in this class was, for the most part, similar to that obtaining in Class I. There remain a certain number in whom, of necessity, the only record of the fact is that appearing in the hospital register or on the death certificate. In many (69 out of 89) such fatal cases, however, the surviving relatives were seen, and bore out the statements gathered from those sources.

Division of subject.

The report is drawn up in four parts. In Part I. an attempt has been made to give some idea of the condition of the district concerned as regards its sanitation, and the prevalence of zymotic disease. The account I have been able to prepare is imperfect in many details, partly from lack of material, partly because at the time of the inquiry attention was mainly concentrated upon the then prevalent epidemic, and the relation of vaccination to small-pox. In Part II. a general outline of the epidemic and its relation to small-pox in other parts of the West Riding are discussed; and a summary analysis given of the chief results regarding the incidence and type of the disease, and the occupations of the patients, and those exposed to infection from them. In Part III. the early history of the outbreak, so far as it could be obtained in each of the districts of the Union that were included, is given; and the facts regarding it and its character, and the vaccination relations of those attacked and those exposed to infection, are analysed in three main groups, Batley and Dewsbury being separately treated, and the remaining infected districts grouped together. In Part IV. the whole series of cases of small-pox is collected, and analysed with especial reference to vaccination.

I take this opportunity of acknowledging my indebtedness to the following gentlemen for kindly giving me every assistance in the prosecution of this inquiry, viz., Mr. Mawdsley, Town Clerk, Mr. W. F. Watts, Medical Officer, Mr. Thackray, Sanitary Inspector, of Dewsbury; Mr. Craik, Town Clerk, Dr. Swann, Medical Officer, Dr. J. Stewart, Acting Medical Officer, and Mr. Lindley, Sanitary Inspector, of Batley;

Dr. Forsyth, Medical Officer, and Mr. Blackburn, Sanitary Inspector, of Birstal; Mr. Broughton, Medical Officer, and Mr. Gledhill, Sanitary Inspector, of Heckmondwike; Dr. Shives, Medical Officer, of Liversedge; Mr. Fairclough, Medical Officer, and Mr. Booth, Sanitary Inspector, of Mirfield; Mr. Steele, Medical Officer, and Mr. Ward, Sanitary Inspector, of Morley; Mr. J. W. Greenwood, Medical Officer, and Mr. Hirst, Sanitary Inspector, of Ossett; Dr. Richardson, Medical Officer, and Mr. Hemingway, Sanitary Inspector, of Ravensthorpe; Dr. Laird, Medical Officer, and Mr. Tuley, Sanitary Inspector, of Soothill Upper; Mr. Clay, Medical Officer, and Mr. Scott, Sanitary Inspector, of Soothill Nether; Mr. Davies, Medical Officer, of Thornhill.



SKETCH MAP OF THE DEWSBURY UNION

PART I.

Topography of the District. Acreage. Population in 1871. 1881, 1891. *Birth rate, death rate, zymotic death rate in* 1891 *and* 1892. *Industries, Manufactures, &c. The "heavy woollen" industry and rug trade. Sanitary state. Dr. Thorne's report in* 1878. *Dr. Barry's reports in* 1886. *Privy middens. Back-to-back houses. Provision for isolation of cases of infectious disease The fever block at the union workhouse infirmary. Vaccination returns. Prevalence of zymotic disease. Previous outbreaks of small-pox.* DEWSBURY.—*Sanitary administration. Statistics of zymotic disease in past years. The Corporation Hospital for infectious diseases. Crow Nest Convalescent Home. Procedure in dealing with small-pox. Ambulance. Disinfection. Vaccination returns* 1891–92. BATLEY.—*Sanitary administration. The Small-pox Hospital. Illingworth's disinfector. Vaccination returns,* 1891–92. *Statistics of zymotic disease.* MORLEY.—*Sanitary administration. Temporary small-pox hospital. Vaccination. Zymotic mortality statistics.* OSSETT.—*Sanitary administration. Fever hospital. Vaccination and mortality statistics.* BIRSTAL.—*Sanitary administration. Vaccination and mortality statistics.* HECKMONDWIKE. — *Sanitary administration. Vaccination statistics.* LIVERSEDGE.—*Sanitary administration. Vaccination and mortality statistics.* MIRFIELD.—*Sanitary administration. Vaccination statistics.* RAVENSTHORPE. — *Sanitary administration. Mortality statistics.* SOOTHILL NETHER. *Sanitary administration. Vaccination statistics.* SOOTHILL UPPER. —*Sanitary administration. Vaccination and mortality statistics.* THORNHILL.—*Sanitary administration. Vaccination and mortality statistics.*

The Dewsbury Union.

The Dewsbury Union, which is co-terminous with the Dewsbury Registration District, is situated in the southern, populous manufacturing part of the West Riding of Yorkshire, below the meridian of Leeds. It is contiguous on the north to the North Brierley, Bramley, Holbeck, and Hunslet Unions, on the east and south-east to the Wakefield Union, on the south and south-west to the Huddersfield Union, and on the west to the Halifax and North Brierley Unions, its boundaries being almost equidistant (about three miles) from Leeds, Bradford, Huddersfield, and Wakefield.*

The area of the whole district is 25,284 acres, and the population (census 1891) 162,596.

The following account of the topography of the district is taken from a report by Dr. Thorne Thorne to the Local Government Board in 1878 †:—

"Speaking generally of the district, it consists of a series of steep undulations intersected by numerous valleys, at times deep and narrow. Here and there are broad, elevated plateaux, and to the south is a considerable expanse of low-lying ground, which forms part of the Calder Valley. This river flows through the district from west to east, receiving in its course numerous tributaries, of which the most important are the Spen Beck and the Dewsbury Beck. Both these becks have different names in different parts of their courses. . . . By far the greater portion of the district generally divides itself into two drainage areas. The first, or the *Spen Beck Drainage Area*, contains Mirfield, north of the Calder, Ravensthorpe, a portion of Dewsbury, Heckmondwike, Liversedge, a portion of Gomersal, and Birkenshaw. On the west the boundary of this area, so far as this registration district is concerned, extends from Mirfield Moor northwards to the west corner of the Liversedge urban district. The eastern boundary runs through Dewsbury northwards, passing through the extreme west of Batley, and through Great Gomersal to Birkenshaw. On the west side of this area small tributary streams divide the country into distinct and prominent ridges, on the east the ground, which rises rather abruptly in places, as, for example, at Dewsbury Moor and Little Gomersal, forms generally a wavy outline being indented with smaller valleys, all of which drain into the main one. The second, or the *Dewsbury Beck Drainage Area*, would include the principal portions of Dewsbury, Soothill Nether, Soothill Upper, and Batley, Birstal, and part of Gomersal, an area of nearly 11 square miles. The western boundary of this area is the eastern one of the Spen Beck, and the eastern one runs through Ossett Street side to the north-east of Soothill Nether through Chidswell in Soothill Upper, and across Bruntcliffe Moor to Adwalton Moor which lies beyond the northern boundary of Birstal. In the northern part of this area a ridge of land extends from Lamp ands through Howden Clough, and divides Batley valley from the narrow valley of the Howley Beck, but these two valleys unite at Batley and have their natural outfall into the Dewsbury Beck. To the north this ridge merges into the watershed which divides the basin of the River Calder from that of the River Aire. The ground between Earlsheaton in Soothill Nether and Hanging Heaton in Soothill Upper takes the form of a broad plateau with a gentle slope towards the south. From the top of the escarpment of the Thornhill Rock which forms the western boundary of this plateau, the slope of the ground towards Dewsbury Beck valley is very abrupt. On the opposite side of this valley the land rises with a steep ascent to the escarpment of the Birstal Rocks and then slopes gradually from Batley Carr to Staincliffe. In a north-westerly direction from Batley the sides of the valley rise less steeply except at Birstal, where the Birstal Rock forms a prominent feature. To the south of these two areas lies a portion of Mirfield and Thornhill. From Mirfield Moor the ground slopes southwards towards the River Calder; the district also lying to the north of a line drawn from the village of Thornhill through Fox-Royd and Lower Whitley and on to Heaton Moor, just beyond the south-western boundary of Mirfield falls rapidly towards the same river. This part of the country is bold and varied, and is conspicuously marked by the high range known as Thornhill Edge. From Thornhill Edge the inclination is very steep down to the Smithy Beck, towards which, on the south, the country, which is intersected by numerous deep and narrow valleys, drains. Beyond the eastern boundary of the Dewsbury Beck area lie the greater portion of Ossett, the eastern part of Soothill Upper and Morley."

Sanitary districts.

The Union contains the following urban sanitary districts:—

Urban Sanitary Districts.	Acreage.	Population, 1891.
1. Dewsbury Borough - - -	1,468	29,847
2. Batley Borough - - - -	2,039	28,719
3. Birkenshaw - - - -	925	2,553
4. Birstal - - - - -	1,233	6,528
5. Gomersal - - - - -	1,096	3,923
6. Heckmondwike - - - -	697	9,709
7. Liversedge - - - -	2,130	13,668
8. Mirfield - - - - -	3,413	11,707
9. Morley Borough - - - -	3,381	18,725
10. Ossett Borough - - - -	3,105	10,984
11. Ravensthorpe - - - -	353	5,134
12. Soothill Nether - - - -	562	5,848
13. Soothill Upper - - - -	1,897	5,645
14. Thornhill - - - - -	3,602	9,606
Total - - -	25,900*	162,596

* In the Registrar-General's summary the total acreage is given as 25,284 acres, the area for Morley being stated at 2,765 acres. The above figures are those quoted in the Annual Summary of the Medical Officer to the County Council of the West Riding, 1892.

Thus, within the Union there are four boroughs, viz.: Dewsbury, Batley, Morley, and Ossett, the corporation being the sanitary authority in each case. Each of the remaining township districts is controlled by a local board, which is the sanitary authority.

It will be seen that there is considerable variation in the area of these 14 districts, as also in the density of their respective populations. In many of them there is much open ground, for example at Thornhill, Mirfield, Soothill Upper, and around Ossett; whilst, on the other hand, the small area of Ravensthorpe is in great part covered by dwellings, as is also Soothill Nether, these two districts flanking the populated borough of Dewsbury.

Statistics of population.

From the following table (Table I.) it will be seen that the population in the whole registration district increased at a far greater rate in the decade 1871 to 1881 than in the next decade, namely, as 1·23 : 1·057; that the greatest rate of increase has been in Morley (1·91 for the 20 years 1871–1891), Thornhill (1·52), Batley (1·37), and the Soothills 1·36).

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* The borough of Dewsbury is about 8 miles from Leeds, 8 miles from Bradford, 5½ miles from Huddersfield, 5 miles from Wakefield.

† *Report to the Local Government Board on the sanitary condition of the Dewsbury Registration District with special reference to the prevalence of infectious diseases in the district.*

The Dewsbury Union.

The subjoined Tables II., III., IV., extracted from the figures given in the Annual Reports of the Medical Officer to the County Council, show that in the years 1891 and 1892 the birth-rate in the whole Dewsbury Registration District was respectively 28·7 and 28·1 per 1,000 of the estimated population; the death-rates during the same period being 24·0 and 19·6 per 1,000. From the same valuable Reports I have extracted the birth-rate, death-rate, zymotic death-rate, and infant mortality in each of the sanitary districts of the union.

Industries.

Industries, Manufactures, &c.—The staple industry of this district is the manufacture of heavy woollen and cloth goods, blankets, and carpets. The trade has made great advances during the last 20 years, and the rapid growth of the population is largely owing to this. Associated with these manufactures is the rag trade, which is very extensive, and for which there is a market held in Dewsbury. This trade employs a large number of persons of both sexes, especially females, in the pursuit of rag-picking and sorting, whilst attached to the woollen mills are departments in which the "rags" are "ground" to shreds to reduce them into a condition suitable for their re-production in cloth-weaving. It may be remarked that the "rags"—which come from all parts of the world, consist of cast-off wearing apparel of all kinds of material, and in all degrees of filthiness. The opportunity thus afforded for the conveyance and dissemination of infected dust would, *à priori*, seem to be extreme, and, except to a very limited extent, there is no effort made to disinfect the "raw material" before submitting it to disintegration and weaving. A certain amount of this material is simply utilised as flock, but the major part undoubtedly forms the staple ingredient of the inferior kind of cloth, commonly known as "shoddy."

In addition to the above industry there are ironworks at Dewsbury and Batley, glass works at Thornhill, chemical works at Birkenshaw, and the whole area is pervaded with coal-pits, of which the most extensive are to be found at Morley, Soothill, Batley, and Dewsbury. Lastly, the more open districts, such as Birkenshaw, Liversedge, Mirfield, Ossett, Soothill Upper, and Thornhill, contain a considerable portion of land devoted to agricultural purposes.

Sanitary Conditions.—At the time of Dr. Thorne Thorne's visit, 20 years ago, the sanitary conditions of the various places within the Dewsbury Union were in a most imperfect state, and the disproportionate prevalence of fever in

Table I.

(*Population of the Dewsbury Union.*)

Registration Sub-district.	Urban Sanitary District.	Population. 1871. Total.	Population. 1871. Per Acre.	Population. 1881. Total.	Population. 1881. Per Acre.	Population. 1891. Total.	Population. 1891. Per Acre.
1. Morley	Morley	9,607	2·8	15,011	4·4	18,725	5·5
2. Batley	Batley	20,871	10·2	27,505	13·4	28,719	14·0
3. Gomersal	Birkenshaw	2,833	3·0	2,699	2·9	2,553	2·7
	Birstal	6,044	4·9	6,766	5·4	6,528	5·2
	Gomersal	4,033	3·6	3,988	3·6	3,923	3·5
4. Liversedge	Heckmondwike	8,300	11·9	9,282	13·3	9,709	13·9
	Liversedge	11,103	5·2	12,757	5·9	13,668	6·4
5. Mirfield	Mirfield	9,959	2·9	11,508	3·3	11,707	3·4
	Ravensthorpe	2,910	8·2	4,364	14·0	5,134	14·5
6. Dewsbury	Dewsbury	24,764	17·4	29,637	20·1	29,847	20·3
7. Soothill	Soothill Nether	4,927	8·7	5,240	9·3	5,848	10·4
	Soothill Upper	3,469	1·8	5,155	2·7	5,645	2·9
8. Ossett	Ossett	9,190	2·9	10,957	3·5	10,984	3·5
9. Thornhill	Thornhill	6,306	1·7	8,843	2·4	9,606	2·6
Dewsbury Registration District		124,286	4·8	153,712	5·9	162,596	6·2

Table II.

Dewsbury Union—Birth-Rate, Death-Rate, Zymotic Death-Rate, and Infant Mortality for the Years 1891 and 1892.

———	Annual Rates per 1,000 of Estimated Population.						Infant Mortality.	
	Birth-Rate.		Death-Rate.		Zymotic Death-Rate.		(Deaths under one Year per 1,000 Births.)	
	1891.	1892.	1891.	1892.	1891.	1892.	1891.	1892.
Batley Borough	29·4	26·7	24·4	21·4	3·1	4·4	239	198
Birkenshaw	23·9	26·8	17·7	16·2	1·6	4·3	115	162
Birstal	28·1	25·4	25·9	18·0	1·5	1·7	240	261
Dewsbury Borough	26·3	27·2	27·9	21·1	3·4	3·6	228	115
Gomersal	21·2	20·9	18·1	13·3	1·8	0·8	120	195
Heckmondwike	28·5	29·3	24·3	19·6	1·4	3·0	188	175
Liversedge	31·9	28·4	25·6	18·7	1·5	1·3	185	174
Mirfield	22·3	22·4	22·1	18·4	2·8	1·3	161	251
Morley Borough	46·0	33·2	23·7	17·4	2·4	2·2	199	138
Ossett Borough	27·0	29·0	19·8	16·5	0·9	1·5	185	132
Ravensthorpe	26·0	26·5	18·2	21·9	3·9	1·7	172	216
Soothill Nether	28·5	27·4	21·2	18·6	1·2	2·5	186	237
Soothill Upper	33·2*	33·7	22·3*	20·2	2·0*	3·4	306*	126
Thornhill	30·0	31·7	17·5	14·6	0·8	0·7	128	162

* Return incomplete. Calculated upon six months' returns.

The Dewsbury Union.

the district was with justice ascribed to these imperfections. Since then, however, considerable improvements have been effected, although there is much still to be done, especially in the matter of excrement disposal, and in house-construction, as will be seen from the extracts of the reports upon the sanitary condition of these districts, which occur in the record of the sanitary survey made by the Medical Department of the Local Government Board in 1886. These excerpts give in a condensed and at the same time comprehensive form the leading defects in sanitation then observed as contrasted with those prevailing eight years previously. At the time of my visit—in the spring of 1892—although some of the houses and localities visited were still unreformed in these respects, yet there were several in which considerable changes had been made. There has, for example, been much done in the way of re-placing the old midden privy by a system of water-closet both in Batley and Dewsbury, and (at least in connexion with the houses I visited) there were not many absolutely bad and open middens. Within the past year or two an extensive sewage works had been erected in Batley, and was in full working, the system employed being that of precipitation, the effluent flowing into the Batley Beck. At these works there is also a large destructor. Drainage works were in progress at Heckmondwike, and, indeed, in most of the districts it was evident that far greater attention was being paid to sanitary conditions than was the case 15 years ago. Still much remains to be done, both in the re-construction or abolition of midden privies, and in house construction. It seems to me that the back-to-back system of dwellings, although regulated by byelaws requiring them to be in blocks of four, with passages intervening still obtained, especially in Batley,* where are to be found most of the recently built houses.

TABLE III.

DEWSBURY UNION.—Population, Total Births, Deaths, and Deaths from Zymotic Diseases.

1891.

—	Area (Acres).	Estimated Population.	Births.	Deaths.	Small-pox.	Scarlet Fever.	Diphtheria.	Croup.	Enteric Fever.	Erysipelas.	Measles.	Whooping cough.	Diarrhœa.
Batley Borough - -	2,039	28,752	846	701	13	8	7	—	12	—	18	7	20
Birkenshaw - - -	1,925	2,549	61	45	—	1	—	—	1	—	—	1	1
Birstal - - - -	1,233	6,522	183	169	—	—	—	1	2	—	5	1	1
Dewsbury Borough - -	1,468	29,852	785	936	14	11	2	5	7	1	34	24	16
Gomersal - - -	1,096	3,921	83	71	—	—	—	—	1	—	1	3	2
Heckmondwike - -	697	9,720	277	231	—	—	—	1	6	1	—	5	2
Liversedge - - -	2,130	13,692	437	342	—	3	3	3	4	1	3	2	2
Mirfield - - -	3,407	11,713	261	259	—	2	6	2	5	3	11	3	2
Morley Borough - -	2,765	18,829	678	446	—	3	1	1	5	1	12	11	12
Ossett Borough - -	3,105	10,985	297	217	—	2	1	3	2	2	2	—	—
Ravensthorpe - - -	358	5,156	134	94	—	1	—	—	—	—	1	—	—
Soothill Nether - -	562	5,655	161	120	—	1	1	1	1	—	1	1	1
Soothill Upper - -	1,897	5,867	189*	131*	?	?	?	?	?	?	?	?	?
Thornhill - - -	3,602	9,626	289	162	—	—	1	—	1	—	1	2	3
Total - -	25,284	162,869	4,681	3,924	27	32	22	17	47	9	89	60	62

* Calculated on estimated rates for six months of year.

TABLE IV.

DEWSBURY UNION.—Population, Births, Deaths, and Deaths from Zymotic Diseases.

1892.

—	Area (Acres).	Estimated Population.	Births.	Deaths.	Small pox.	Scarlet Fever.	Diphtheria.	Croup.	Enteric Fever.	Erysipelas.	Measles.	Whooping Cough.	Diarrhœa.
Batley - - - -	2,039	28,883	772	618	49	16	18		7	3	4	16	17
Birkenshaw - - -	925	2,535	68	41	—	8	2	—	—	—	—	1	—
Bristol - - - -	1,233	6,499	165	117	—	1	—	1	—	—	7	1	1
Dewsbury - - -	1,468	29,873	812	724	45	11	1	—	7	2	8	20	21
Gomersal - - -	1,096	3,915	82	52	—	2	—	—	1	—	—	—	—
Heckmondwike - -	697	9,764	286	186	1	8	—	—	1	—	6	7	1
Liversedge - - -	2,130	13,786	391	261	1	5	—	1	2	—	1	5	3
Mirfield - - -	3,413	11,735	263	216	—	1	—	1	—	3	—	5	3
Morley - - - -	3,381	21,598	716	376	1	8	4	1	3	3	1	15	14
Ossett - - - -	3,105	10,988	319	181	1	7	1	—	3	1	—	1	3
Ravensthorpe - - -	352	5,247	139	118	—	2	—	—	1	—	—	2	2
Soothill Nether - -	562	5,698	156	106	—	—	—	—	—	—	3	4	7
Soothill Upper - -	1,897	5,894	199	119	1	4	2	—	5	—	—	7	1
Thornhill - - -	3,602	9,706	308	142	1	1	—	1	—	—	—	1	3
	25,900	166,121	4,676	3,257	100	74	33		30	12	30	85	76

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* *I have since been informed by Dr. Swann that this is not the case.—S. C.*

EXTRACT from " ABSTRACTS of INSPECTORS' REPORTS on the SANITARY SURVEY of ENGLAND and WALES made in anticipation of CHOLERA, 1886."—Annual Report Medical Officer Local Government Board for 1886.

1.	2.	3.	4.	5.	6.	7.	8.	9.
Urban Sanitary District, Inspector, and Date of Report, Population (1881), Industries, &c.	Cleanliness of Roadways and Domestic Premises.	Sewering and Drainage.	Excrement Disposal and Removal.	Refuse removal.	Water Supply.	Sanitary Conditions of Dwellings of Poor.	Crowding of Dwellings on Area.	Overcrowding of Dwellings.
Dewsbury - - - Dr. Barry, November 1886. Population, 29,617. (Woollen works, collieries, and iron works.)	Private streets neglected and in unsatisfactory condition.	Sewering just completed. Ventilators choked with dirt or with charcoal boxes. Many houses still have sink pipes not disconnected from sewers.	Chiefly midden privies, some draining into sewers. Many of the worst existing at Dr. Thorne's inspection in 1878 have been abolished and w.c.'s substituted otherwise much as before.	Unsatisfactory -	Public supply on constant system. Some improvements in conduit complained of by Dr. Thorne in 1878, but other sources of possible danger exist.	Still much wretched property grouped round filthy yards, but considerable improvement since Dr. Thorne's inspection in 1878. Many cellar dwellings illegally occupied.	Much, and in older parts many small courts.	Not much.
Batley - - - Dr. Barry, September 1886. Population, 27,514. (Woollen works.)	Back and private streets in disgraceful condition, and many courts and yards exceptionally bad.	Sewering incomplete. Districts referred to as unsewered by Dr. Thorne in 1878 remains so still. Branch sewers everywhere defective. Ventilation very inadequate. Majority of house waste-pipes disconnected but others not, and sewer air entering dwellings.	Midden privies of worst type all but universal; very often against dwelling-houses, and source of great and dangerous nuisance. Excremental filth soaking into houses with exceptional frequency as at Dr. Thorne's inspection in 1878.	Unsatisfactory; great accumulations.	Public supply on constant system; good quality. In some instances sewers flushed direct by overflow from reservoir.	Very damp, and surrounded by filthy dangerous nuisances.	Great crowding in older parts. A very large proportion of back-to-back houses.	Not much.
Ossett and Gawthorpe - Dr. Barry, November 1886. Population, 10,937. (Collieries, woollen works, semi-rural district.)	Private streets often in disgraceful condition, yards and courts often unpaved and sloppy.	Completely sewered. Sewers ventilated. Waste pipes mostly disconnected.	Midden privies, many of which have been improved since Dr. Thorne's inspection in 1878. Still some remain as dangerous nuisances. In some instances insufficient accommodation.	Unsatisfactory; much accumulation.	Public supply from Batley Corporation on constant system. Public wells all closed.	Many damp from lack of eave spouting, otherwise fair.	None - - -	None.
Ravensthorpe - - Dr. Barry, October 1886. Population, 5,000. (Woollen works, collieries, &c.)	Satisfactory - - -	Completely sewered. Sewers ventilated and flushed.	Midden privies, but great improvements since Dr. Thorne's inspection in 1878.	Satisfactory - -	Public supply from Dewsbury Waterworks on constant system.	Generally exceptionally good. Many back-to-back, but none so built since Dr. Thorne's inspection.	Not to any serious extent.	None.
Heckmondwike - - Dr. Barry, November 1886. Population, 9,282. (Blanket and carpet making.)	Private streets unsatisfactory. Many courts and yards unpaved and sloppy.	Sewering (although some sewers have been put in) still very unsatisfactory as at Dr. Thorne's inspection in 1878. House drainage also unsatisfactory.	Midden privies, commonly exceptionally bad, although a certain number have been covered since Dr. Thorne's inspection in 1878.	Satisfactory - -	Public supply from Dewsbury Waterworks on constant system.	Considerable improvements made in older parts since Dr. Thorne's inspection in 1878.	Much needless crowding and many back-to-back houses.	None.
Thornhill - - - Dr. Barry, November 1886. Population, 8,843. (Woollen works, glass works, collieries, agriculture.)	Fair - - - -	No public works of sewering done, and sewering and drainage remain in same condition as at Dr. Thorne's inspection in 1878, except for the disconnection of a number of sink pipes.	Midden privies; about one half are still in the former unsatisfactory condition, while half have been improved satisfactorily.	Satisfactory - -	Public supply from Dewsbury Waterworks on constant system.	Exceptionally good - -	None - - -	None.
Mirfield - - - Dr. Barry, November 1886. Population, 11,508. (Woollen and cotton mills collieries, agriculture.)	Good, except private streets, which were unsatisfactory.	All north of Calder sewered, with means of ventilation and flushing. South of Calder not sewered, but houses connected still with old drains. House connexions in progress under careful regulations.	Midden privies mostly roofed over since Dr. Thorne's inspection in 1878, but still sloppy from admission of ground water.	Satisfactory - -	Public supply from Huddersfield Corporation. Water acts powerfully on lead, and much lead poisoning has resulted.	Good - - - -	Little overcrowding. Erection of back-to-back houses discontinued since Dr. Thorne's inspection.	None.

1.	2.	3.	4.	5.	6.	7.	8.	9.
Urban Sanitary District, Inspection, and Date of Report, Population (1881), Industries, &c.	Cleanliness of Roadways and Domestic Premises.	Sewering and Drainage.	Excrement, Disposal and Removal.	Refuse Removal.	Water Supply.	Sanitary Conditions of Dwellings of Poor.	Crowding of Dwellings on Area.	Overcrowding of Dwellings.
Soothill Upper Dr. Barry, November 1886. Population, 5,155. (Woollen works, collieries, agriculture.)	Good	No system of sewering. Drainage in same condition virtually as at Dr. Thorne's inspection in 1878. In many instances interior of houses in direct communication with faulty drains through sink pipes.	Midden privies of bad type and uncovered. Many drain into the faulty drains.	Unsatisfactory; large accumulations.	Public supply on constant system from Halifax Corporation; satisfactory.	Exceptionally good. Some damp for lack of eave spouting, and some cellars illegally occupied.	Not to any serious extent.	None.
Soothill Nether Dr. Barry, November 1886. Population, 5,240 (Blanket making, collieries, &c.)	Private streets and yards frequently unchannelled, sloppy, and filthy.	No system of sewering. House drains very defective; house sink pipes directly communicating with old faulty drains.	Midden privies, many still of old objectionable type as at Dr. Thorne's inspection in 1878, but improvements made in construction in respect of new houses.	Satisfactory	Public supply from Dewsbury Waterworks on constant system.	Fairly good, but many damp for lack of eave spouting.	Not to any serious extent.	None.
Gomersal Dr. Barry, November 1886. Population, 39,888. (Wool, cotton, and silk works, chemical works, &c.)	Many private streets in unsatisfactory condition.	Partially sewered, but Great Gomersal still dependent on old square channels and surface drains. House waste pipes as a rule disconnected.	Midden privies, many in same unsatisfactory condition as at Dr. Thorne's inspection in 1878, but a large number altered and now satisfactory.	Satisfactory	Public supply from Bradford Waterworks on constant system.	As a rule satisfactory; some cellars illegally occupied.	Not to any serious extent.	None.
Morley Dr. Barry, November 1886. Population, 15,011. (Cloth-weaving, collieries, &c.)	Fair on the whole. Some yards and courts unpaved and sloppy.	Greater part sewered, but ventilation imperfect. Disconnection of sink pipes actively progressing since Dr. Thorne's inspection in 1878.	Almost universally midden privies, still some objectionable, but a considerable number materially improved since Dr. Thorne's inspection in 1878.	Not sufficiently frequent.	Public supply from Leeds Corporation on constant system.	Imperfect ventilation and want of eave spouting in older parts, where also there are some dilapidated houses unfit for habitation.	Many courts and back-to-back houses.	None.
Birkenshaw Dr. Barry November 1886. Population, 2,699. (District rural; worsted mills, collieries, chemical works, agriculture.)	Private streets unsatisfactory.	Complete system of sewering just completed with means of flushing and ventilation. House connexion next to be seen to.	Midden privy system, same as at Dr. Thorne's inspection in 1878, since that a few middens have been covered.	Unsatisfactory; large accumulations.	Public supply from Bradford Corporation on constant supply.	Some damp from lack of eave spouting, otherwise fair.	Some back-to-back houses.	None.
Birstal Dr. Barry, November 1886. Population, 6,768. (Collieries, iron-works, woollen works, &c.)	Many yards and courts unpaved, sloppy, and filthy.	Sewered, but still many houses are not connected with system. Main sewers insufficiently ventilated, branch sewers unventilated.	Midden privies still (except on new property) of the worst type.	Until recently very bad indeed, accumulations of years. Much improved of late.	Public supply from Bradford Corporation on constant system.	Good as a rule, but some old dilapidated houses unfit for habitation.	Not to any serious extent. Back-to-back houses sanctioned by private Act of Parliament (1872).	None.
Liversedge Dr. Barry, November 1886. Population, 12,757. (Carpet, blanket, worsted, and cotton works, collieries, &c.)	Private streets very unsatisfactory. Many yards and courts unpaved and sloppy.	Majority of houses still in unbroken connexion with interior of sewers. Altogether much as at Dr. Thorne's inspection in 1878. Sewering completed (except at Moorbottom and New Town). House connexions progressing and waste pipes are being cut off.	Midden privies almost universally, mostly deep, uncovered, and sloppy, and sources of dangerous nuisances. Some drained into sewers.	Fair	Public supply from Bradford Corporation on constant system, but still, as at Dr. Thorne's inspection in 1878, some resort is had to Lion Mouth spring, liable to pollution.	Many damp, old, and dilapidated houses. Great lack of eave spouting.	Very large proportion of back-to-back houses. Some cellars illegally occupied, much needless crowding has been permitted.	None.

Provision for Isolation of Cases of Infectious Disease.

The Dewsbury Union Isolation hospitals.

Until the occurrence of small-pox in 1891–92, the districts of this Union were very imperfectly provided with means for the isolation of infectious cases. A special "fever" block at the workhouse infirmary at Staincliffe, a fever hospital at Dewsbury (erected 1887), and one at Ossett, formed the only institutions of this class. It will be seen in dealing with the history of the outbreak, that as it progressed steps were taken both at Batley and Morley, to remedy this defect, but only with buildings of a temporary character. When I arrived in the district in April 1892, a scheme had nearly been carried for a conjoint hospital for infectious disease on the part of several districts, but this scheme fell through, and I am not aware whether any further action has been taken to attain this desirable end.

The *infectious block* of the Union workhouse infirmary at Staincliffe is a stone building consisting of two floors, the administration (nurses' rooms) forming the centre, and on each side there being two male and two female wards. Each ward contains five beds, so that the total accommodation of 20 beds is singularly inadequate for the needs of the union. The building runs parallel to and about 10 to 15 yards distant from the main building of the workhouse infirmary. Although the nurse in charge of the infectious block does not enter the main building, the food-supplies of the patients in it are furnished from the workhouse kitchen and stores, and placed on a table in the area between the two buildings, whence it is taken by the nurse. It may be added that the laundry for the infirmary closely adjoins the fever house (being about 7 yards distant from the left wing).

Vaccination in the Dewsbury Registration District.

Vaccination.

The returns of vaccinations performed during the past 20 years (1870–89) show that there has been an increase in the numbers of children who escaped vaccination, amounting of late years to about one-third of the total births in each year (Table V.). There is not, and has not been for some time, any pressure to enforce the law, and many of those children were not vaccinated because, as more than one mother informed us, "no one troubled them about it." The registrar of births and deaths in Batley informed Mr. Fardon that there was "no such widespread aversion to "vaccination amongst the inhabitants as has been sup-"posed, but that the large number of unvaccinated cases "is due in great measure to the supineness of the vaccina-"tion officer who is probably encouraged in his apathy by "the Board of Guardians, the majority of whom at present "are opposed to the vaccination laws." He added that he (the registrar) "had formed this impression from conversa-"tions he has had with relatives of those who had died from "the disease (small-pox) coming to his office for purposes "of registration."

Zymotic Diseases.—In his report on the sanitary conditions of the Dewsbury Registration District in 1878 Dr. Thorne Thorne demonstrated that the mortality from "fever" was disproportionately high. The mean death rate (per 10,000 living) for the whole district from this cause was found by him to be 8·3, whereas in London during the same period it was 4·1, and for "large towns "and cities of England," 5·4.

I have endeavoured to bring Dr. Thorne's returns up to date, and am indebted to the medical officers of health for furnishing me, wherever possible, with the necessary statistics. These will be found in detail under the head of each district concerned. The returns are not complete for some of the years, and I can quote none from Heckmondwike, Mirfield and Soothill Nether. However, such figures as I have obtained suffice to show that since the period named there has been a notable decline in mortality from this class of disease. To make the comparison as clear as possible I have compiled the following table (VI.), which gives the per-centage rate on the mean total deaths from all causes of the mortality from the chief classes of zymotic disease. The calculation for the years prior to and including 1877 is made on the figures given in Dr. Thorne's report. Those for other years (grouped in all cases when returns are available in quinquennial periods) are from the figures given me by the medical officers of health, excepting those for 1891 and 1892, which are taken from the reports of the medical officer to the West Riding County Council.

It may be added that the zymotic death rate in the Dewsbury District for 1891 is less than that for the whole country in that year. (Fifty-fifth Annual Report of the Registrar-General of Births, Deaths, and Marriages in England, 1891.)

TABLE V.

Dewsbury Union.

YEAR.	Births registered during year.	Of the children whose births were registered during the year given in the first column, by the 31st January in the year next but one following that year there were:—						
		Successfully vaccinated.	Certified as insusceptible of vaccination.	Had Small-pox.	Died Unvaccinated.	Vaccination postponed by Medical Certificate.	Remaining.	The children not finally accounted for (including cases postponed) being per cent. of births.
1872	5,279	4,256	1	3	643	376		7·1
1873	5,358	2,886	9	2	726	3	1,732	32·4
1874	5,510	2,713	1	6	844	9	1,937	35·3
1875	5,323	3,456	1	0	648	45	1,173	22·9
1876	5,661	3,031	2	1	756	42	1,829	33·0
1877	5,815	4,048	3	0	733	86	945	17·7
1878	5,914	4,382	2	0	730	66	734	13·5
1879	5,433	4,177	3	0	545	63	645	13·0
1880	5,379	3,754	9	0	713	82	821	16·8
1881	5,248	3,611	3	1	595	92	946	19·8
1882	5,196	3,910	5	1	624	77	579	12·6
1883	5,237	3,684	5	0	508	62	978	20·0
1884	4,991	2,497	4	0	613	24	1,853	37·6
1885	4,947	2,093	3	0	515	29	2,307	47·2
1886	4,975	2,427	5	0	678	88	1,777	37·5
1887	4,987	2,812	6	0	695	53	1,421	29·6
1888	4,843	2,644	4	0	634	53	1,508	32·2
1889	4,660	2,281	3	0	637	69	1,670	37·3
1890	4,619	2,090	5	0	718	66	1,740	39·1
1891	4,601	2,347	11	3	743	61	1,436	32·5
1892	4,616	2,139	9	1	727	73	1,667	37·7

The Dewsbury Union.

Small-pox in Previous Years.—For nearly nine years the Dewsbury Union had enjoyed an almost complete immunity from small-pox until the outbreak in 1891. This fact alone deserves mention in view of the presumed liability to the introduction of the disease by infected rags coming from abroad. Were this a common medium of small-pox infection it is hardly conceivable that outbreaks of the disease should not be, as frequent in these industrial centres as they are in the main seaports, where hardly a year passes without the introduction of some cases into the port. At the same time, the periods of its incidence in this district has fairly corresponded with the general prevalence in England as a whole. I am again unfortunately not able to give complcte returns, but the subjoined table (VII.) comprises most of the districts of the Union, and those the most populous. It will be seen that small-pox was the cause of many deaths in the years 1873 to 1875. The period 1871–75 stands highest of all the seven quinquennial periods, 1888–90, for the small-pox mortality in England. In that quinquennium the small-pox deaths in the whole country were 410·8 per million living. During each of the next quinquennia this rate for the whole country is precisely the same, viz., 78·4; and it will be observed that the figures given in the appended table, approximate to the degree of reduction in mortality from small-pox thus expressed for the whole country. Finally, in the five years 1886–90, when the general death-rate from small-pox was as low as 13·2, only two deaths are given as occurring in Dewsbury.

Table VI.

Comparative Statistics of Mortality in Groups of Years in Various Districts of the Dewsbury Union.

——	Periods of Years.	Mean of total Deaths in each Period.	Proportion to Mean Total Deaths of Deaths from					
			"Fever."	Small-pox.	Scarlet Fever.	Diphtheria.	Measles.	Diarrhœa and Dysentery.
			(Per 100 Deaths from all Causes.)					
Batley - - -	1873–77	605	3·1	0·8	8·2	?	?	6·4
	1884–87	601	1·2	—	3·4	2·6	3·9	6·2
	1888–92	599	1·4	2·0	1·8	1·6	2·2	4·0
Birstal - - -	1875–77	136	2·7	—	3·6	?	?	1·6
	1878–82	149	2·7	0·1	4·0	0·4	1·7	1·6
	1883–92	133	0·4	—	0·3	0·6	2·8	0·4
Dewsbury - -	1873–77	692	3·3	4·3	7·6	?	?	3·7
	1878–82	752	2·0	0·6	3·1	0·2	2·0	4·0
	1883–97	651	1·4	—	2·3	0·3	1·2	5·6
	1888–92	744	1·2	1·6	1·8	0·3	2·5	2·9
Liversedge - -	1875–77	282	1·7	—	6·4	?	?	4·5
	1880–82	261	0·9	—	1·6	1·0	1·5	4·2
	1883–87	224	1·6	—	1·7	—	0·8	2·0
	1888–92	259	0·5	—	0·8	0·3	0·8	1·2
Morley - - -	1873–77	288	2·5	2·5	8·3	?	?	3·5
	1878–82	800	1·8	—	2·7	0·2	3·0	4·4
	1883–87	334	1·2	—	9·0	0·7	3·6	4·8
	1888–92	341	0·7	—	0·8	0·4	1·9	3·7
Ossett - - -	1873–77	219	1·9	0·7	6·8	?	?	3·5
	1883–87	191	0·5	0·1	4·5	0·4	1·3	2·5
	1888–92	198	0·5	0·1	1·8	0·6	0·7	1·2
Ravensthorpe - -	1875–77	73	3·1	1·3	—	?	?	4·0
	1878–82	80	1·0	—	3·2	—	1·5	1·2
	1883–87	80	1·5	—	2·0	0·7	4·2	2·2
	1888–92	97	0·8	—	1·6	—	2·0	1·8
Soothill, Upper - -	1875–77	100	4·0	1·0	6·6	?	?	4·3
	1883–87	101	1·2	—	1·8	0·2	1·4	0·6
	1888, 1890–92	108	2·3	0·4	2·3	0·6	1·6	1·8
Thornhill - -	1873–77	147	4·0	0·7	3·8	?	?	1·6
	1878–82	170	2·0	0·1	4·0	0·1	0·8	0·5
	1884–87	155	1·0	—	1·7		2·1	3·3
	1888–92	165	0·9	0·1	0·3	0·1	2·1	2·7

The Dewsbury Union.

I propose now to give a brief sketch of the sanitary administration of each of the districts of the union in which cases of small-pox have occurred during the period covered by this inquiry. For full details respecting the topography, &c. of the districts I may refer to Dr. Thorne Thorne's report.

Dewsbury.

Dewsbury borough.

The municipal borough of Dewsbury has an area of 1,468 acres, and a population in 1891 of 29,847.

The sanitary administration is under the control of the Town Council, the Medical Officer of Health being W. F. Watts, Esq., M.R.C.S.

There is one sanitary inspector, Mr. J. Thackray. Notification of infectious diseases has been in force in the borough since 1884.

Fever hospital.

The Borough Hospital for infectious diseases (*see* Plan) was opened in 1888, and since June 1891 had been used exclusively for small-pox, cases being admitted from Heckmondwike, Ravensthorpe, Thornhill, Soothill Nether, as well as from the borough. It will be seen later that with but few exceptions, every case of small-pox arising in Dewsbury was thus isolated. The building is situated on a fairly open site, on low ground, at the extreme south-western boundary of the borough. It stands on land belonging to the cemetery, between the Huddersfield and Heckmondwike roads, and has but few inhabited dwellings within 500 yards of it. The building, which is constructed of wood and iron, was extended in 1892, and comprises in all five wards (48 ft. long by 20 ft. wide, and about 12 ft. high), holding from 10 to 15 beds, and a central administration block, containing nurses' rooms and bath-room. The Medical Officer of Health is in charge of the Hosptial, which he visits once or twice daily, and the nursing is done by a resident matron, and a staff of two to four nurses, according to the number of cases under treatment. The accommodation for administrative purposes is somewhat limited, whilst that for bathing patients was (at the time of my visit) certainly inadequate. During the height of the epidemic the resources of this building were severely taxed, but fortunately, a property adjoining the site had been recently acquired by the Corporation for a public park, and the mansion "Crow Nest," standing on high ground above the Heckmondwike road, was fitted up to receive convalescent patients, who were drafted there as soon as practicable, and retained until they were declared by the medical officer free from infection. By this means the hospital wards were made available for acute cases, and fortunately the accommodation sufficed to admit them all.

The procedure adopted in cases of small-pox consists in the prompt removal to hospital upon receipt of notification, followed by disinfection of the house, &c. The Corporation possesses a special ambulance, and the sanitary inspector accompanies it to the house, and superintends the transference of the case. The inspector selects such articles from the room which the patient has occupied which, in his opinion, are likely to retain infection, such as bedding, &c. These are taken to the hospital, all flock being burnt; linen and clothing fumigated with sulphur. The disinfection of the room is effected by sulphur-fumigation, the room being sealed up for five hours. At the end of that time the room is opened, and the inmates directed to have it re-papered and whitewashed at the discretion of the inspector. The Corporation supply carbolic soap for cleansing purposes after the fumigation, and replaces articles that may have been destroyed. The ambulance is fumigated after each case has been removed, and a separate vehicle is used for the conveyance of convalescent patients.

Every patient on admission to the hospital is bathed (unless too ill), and before his discharge he has a course of baths; but, as already stated, this service was defective. There are only two baths in the building, and the means of heating the water is inadequate. Before the discharge of a patient his clothes are fumigated, and he does not re-enter the ward to leave the building after taking the bath—a similar precaution being adopted at Crow Nest as at the hospital.

Re-vaccination of inmates of houses from which cases were removed was carried out by the medical man in attendance in some instances, but in no great proportion of the whole.

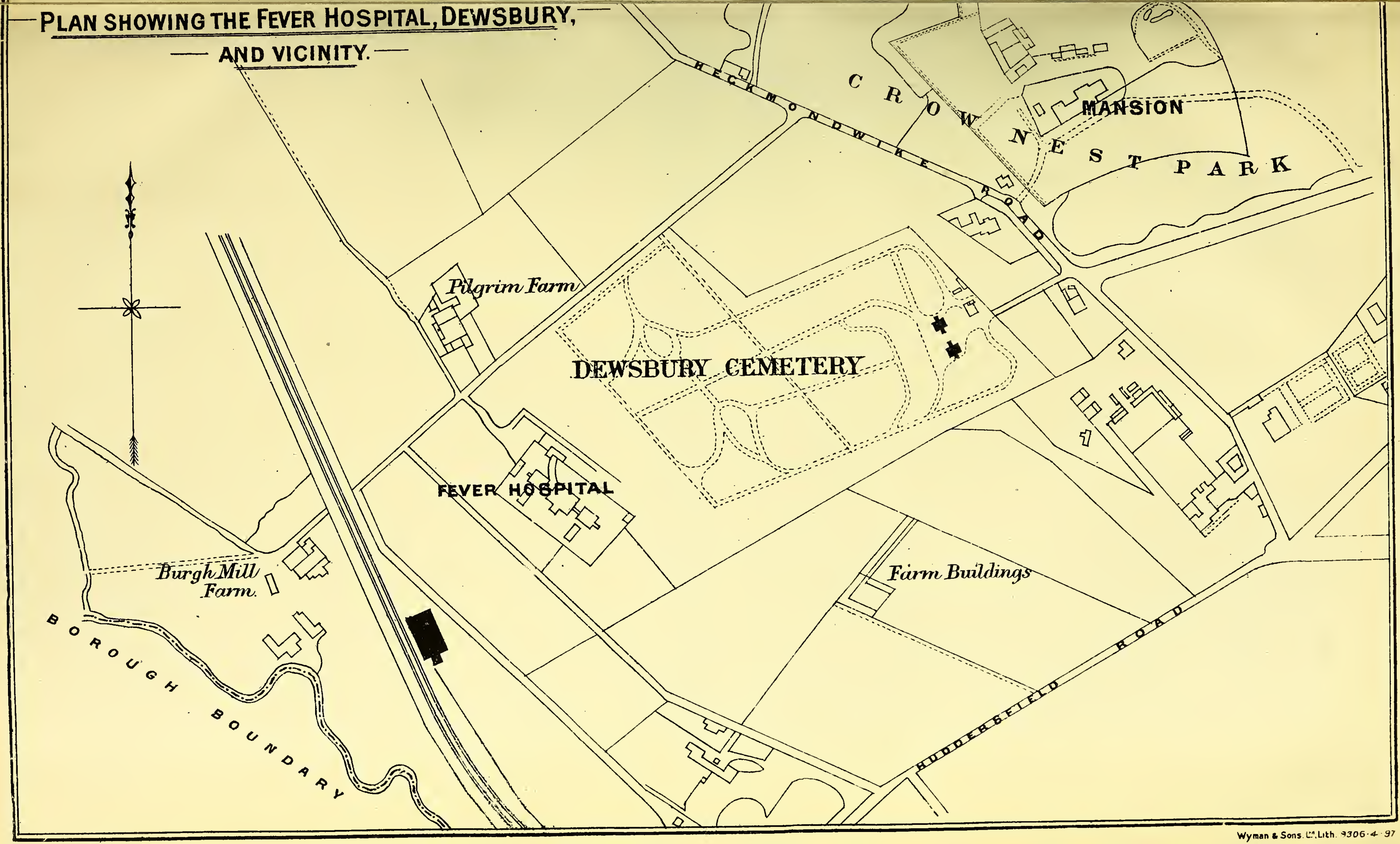
The amount of vaccination in the borough and the union workhouse during the first year of the epidemic may be seen in the appended return (Tables VIII. and IX.).

TABLE VII.

SMALL-POX DEATHS in DISTRICTS of DEWSBURY UNION (exclusive of BIRKENSHAW and GOMERSAL).

—	Dewsbury.	Batley.	Bristol.	Heckmondwike.	Liversedge.	Mirfield.	Morley.	Ossett.	Ravensthorpe.	Soothill Nether.	Soothill, Upper.	Thornhill.
1873 - -	14	10	No return.	No return.	!No return.	No return.	36	—	No return.	No return.	No return.	—
1874 - -	129	7	„	„	„	„	1	7	„	„	„	5
1875 - -	5	7	—	4	—	2	—	1	3	—	3	—
1876 - -	—	—	—	1	—	—	—	—	—	—	—	—
1877 - -	—	—	—	—	—	—	—	—	—	—	—	—
1878 - -	3	—	—	No return.	—	No return.	—	1	—	No return.	—	—
1879 - -	1	No return.	—	„	—	„	—	—	—	„	—	—
1880 - -	4	„	—	„	—	„	—	—	—	„	—	—
1881 - -	7	„	—	„	—	„	—	7	—	„	—	—
1882 - -	9	„	1	„	—	„	—	2	—	„	—	1
1883 - -	—	„	—	„	—	„	—	1	—	„	—	No return.
1884 - -	—	—	1	„	—	„	—	—	—	„	—	—
1885 - -	—	—	—	„	—	„	—	—	—	„	—	—
1886 - -	—	—	—	„	—	„	—	—	—	„	—	—
1887 - -	—	—	—	„	—	„	—	—	—	„	—	—
1888 -	2	—	—	„	—	„	—	—	—	„	—	No return.
1889 - -	—	—	—	„	—	„	—	—	—	„	—	—
1890 - -	—	—	—	„	—	„	—	—	—	„	—	—
1891 - -	14	13	—	„	—	„	—	—	—	„	—	—
1892 - -	45	49	—	1	1	„	1	1	—	„	1	1

PLAN SHOWING THE FEVER HOSPITAL, DEWSBURY, AND VICINITY.



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The Dewsbury Union.

TABLE VI.

DEWSBURY UNION.

Dewsbury District.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892, inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under One Year.	Between One and Two Years.	Two Years and Upwards.	All Ages.
1891.—January	—	—	—	—
February	—	—	—	—
March	8	5	2	—
April	2	1	—	—
May	6	5	3	—
June	13	4	6	—
July	1	—	2	—
August	9	—	4	—
September	2	—	2	—
October	10	4	6	—
November	6	3	2	—
December	2	1	1	—
1892.—January	—	—	—	—
February	25	4	11	—
March	8	10	20	—
April	6	1	1	—
Totals	98	38	60	—

TABLE IX.

DEWSBURY UNION.

The Workhouse.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892, inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under One Year.	Between One and Two Years.	Two Years and upwards.	All Ages.
1891.—January	—	—	—	—
February	—	—	—	—
March	—	—	—	—
April	—	—	—	—
May	—	—	—	—
June	—	1	1	—
July	1	—	4	13
August	—	—	—	—
September	—	—	—	—
October	—	—	1	—
November	—	—	—	—
December	—	—	—	—
1892.—January	—	—	4	1
February	—	—	—	—
March	—	—	—	—
April	—		—	—
Totals	1	1	10	14

The following table (X.) gives the mortality statistics of the borough during the past 20 years, the means for each quinquennium being calculated to facilitate comparison. The figures for 1873–77 are from Dr. Thorne Thorne's Report in 1878. [The estimated population in the intercensal periods is calculated on the difference between the adjoining census returns, with the correction up to the middle of the year. In the census years, however, I have retained the figures given at the census.]

TABLE X.

MORTALITY STATISTICS for the BOROUGH of DEWSBURY for the Years 1873–92.

—	Estimated Population.	Total Deaths, all Causes.	"Fever."		Small-pox.	Scarlet Fever.	Diphtheria.	Measles.	Diarrhœa and Dysentery.
			Typhus.	Enteric.					
Mean for 1873–77	27,411	692	28		30	51	?	?	33
1878	27,809	839		19	3	69	?	?	42
1879	28,784	718		13	1	20	1	6	14
1880	29,271	763		18	4	18	3	27	66
1881	29,637(c)	662		5	7	7	5	1	11
1882	29,663	780		18	9	5	2	39	18
Mean for 1878–82	29,172	752		15·6	4·8	23·8	2·7*	15·8*	12
1883	29,684	649		9		4	5	3	12
1884	29,705	592		10		23	2	5	49
1885	29,726	661		8		18		7	24
1886	29,747	600	1	5		18	2	14	72
1887	29,768	751	1	13		14	2	12	79
Mean for 1883–87	29,726	651	0·4	9	—	15·4	2·2	8·2	37·4
1888	29,789	695	1	15	2	23	3	12	19
1889	29,810	693	1	12		13	4	39	35
1890	29,831	661		5		11	4	3	18
1891	29,847(c)	936		7	14	11	2	34	16
1892	29,873	724		7	45	11	1	8	21
Mean for 1888–92	29,830	741	0·4	9·1	12·2	13·8	2·8	19·2	21·8

* Four years.

The Dewsbury Union.

Batley.

Batley borough.

The area of the borough is 2,039 acres, and the population at the Census of 1891 is returned as 28,719. It is a municipal borough, the Town Council being the sanitary authority, a Committee of the Council having the direction of sanitary measures.

Dr. A. Swann is the medical officer of health, and during the winter of 1891–2 in his absence from ill-health, the duties of the office were energetically carried on by Dr. I. Stewart. The sanitary inspector is Mr. J. Lindley, who during the chief months of the small-pox outbreak had two assistants working under his direction.

The Notification Act was adopted by Batley on March 1, 1891, and was therefore in force for two months prior to the commencement of the outbreak of small-pox.

Small-pox hospital.

At this time the borough was unprovided with any hospital for the isolation of cases of infectious disease; and some of the small-pox cases were admitted into the workhouse infirmary at Staincliffe. In the month of December, however, when the disease again broke out, and when in consequence of the action of the Local Government Board, cases of small-pox could no longer be admitted into the workhouse, the Batley Corporation took steps to acquire a site and erect a temporary small-pox hospital (see plan). The buildings which are on the Decker principle were erected with great despatch and ready for occupation in the first week in January, 1892. The site acquired for this purpose was on high ground near the Birstal-Batley boundary, in a field to the left of the Upper Batley Lane leading to Howden Clough. The situation is an open one, the nearest houses being two cottages in the above-named road; the nearest to the hospital buildings (as finally completed) being distant 365 feet. The original buildings were obtained in London, where they had been used for other purposes, and the windows were small and roof low (only 7 feet from floor to eaves.) The building was, however, provided with an extra wood floor and corrugated iron roof. It consisted of three wards arranged in a T shape, but not intercommunicating, each being 34 feet long by 17 feet wide (*see* Plan). The following is from a published account of these buildings when in progress:—

"The buildings will be warmed by slow combustion stoves, and ample means are provided for ventilation by a cylindrical tube which surrounds the flue pipe from the stove. By this arrangement the germs of disease are destroyed by heat before reaching the outside air. As regards the construction of the buildings it may be said that the sides consist of leather and jute mixed, with a cavity between, and lighted all round by small windows made to open with Louvre ventilators. Two gaslights are fixed in each hospital, the height of which, from floor to roof, is about 10 feet. Two of the buildings are placed lengthwise, the third jutting from the centre, and a covered portico roof is provided to the entrance of each hospital. Spring mattresses, with palliasse beds and pillows, have been purchased, while sheets, wool blankets, and warm-looking counterpanes complete the outfit. The best of everything has been obtained—in fact no effort has been spared for the comfort of inmates. Among the necessaries, or accessories of the place, are to be found a bath-room, surgery, and kitchen, fitted up with two portable gas cooking stoves. Hot water will be supplied to the bath by means of a portable boiler, holding about 60 gallons. A washhouse is also included in the arrangements, and is fitted up with the usual requisites. Pail closets have been erected in connexion with each ward, and these will be entered from a narrow passage, ventilated so as to prevent any effluvium entering the hospitals. There is also provided a disinfecting chamber, while a new cab has been specially purchased for the removal of patients. The vehicle will be disinfected on every occasion it is used. Drains have been laid down, and these are disconnected over trapped gulleys, emptying into a properly constructed sump, the contents of which will be conveyed away periodically."

There was also constructed a separate residence for the matron about 40 yards distant from the wards and adjacent to another building which formed the kitchen. This was fitted up in February 1892, at the same time that another block of two wards, to accommodate about 32 patients and the nursing staff, was erected. These wards were constructed of wood, the walls being filled with sawdust, and although much on the same pattern as the original wards, they were loftier and wider, with also somewhat larger windows. These two wards were utilised for convalescent cases, the nurses' room being at the end of the female ward. In addition to this nursing staff there was a male attendant employed. Dr. Stewart had sole medical charge of the hospital, and frequently visited it more than once daily. During the months of January to April 1892, it was kept constantly full of patients, who came not only from Batley but also from Birstal, Mirfield, and Soothill Upper.

It may be of interest to note the means taken to dispose of the excreta and infected material at this hospital. All the ash and dust and food-refuse, &c. was collected and daily removed in a special covered van to the town destructor at the sewage works, Bradford Road, where it was burned. The excreta received into pail closets were treated with carbolate of lime, and the pails daily emptied into a shallow pit, dug in the middle of the field (near Windmill Lane, see plan) on which the hospital stands. About once a month the pit was emptied, and the contents conveyed to the destructor to be burned. The waste-water, slops, bath-water, &c. were drained into a sewage tank (site marked in the plan) in the field, the contents of which were pumped into an iron cart, for conveyance to a convenient place where they were discharged into the town sewers.

The patients before leaving the Hospital were given a disinfectant bath, their clothing being at the same time fumigated with sulphur. On leaving the patient went out by a separate exit, and thus did not again come in contact with any of the remaining patients.

Some trouble was occasioned by the convalescent patients crossing the field to the lane to converse with friends who came up (especially on Sunday afternoons) to see them or bring them articles. A low hedgerow bordered the field, and in order to check this possible source of infection, it was found necessary to station a police officer in the lane to prevent any access of strangers to the hospital precincts.

Meas adop

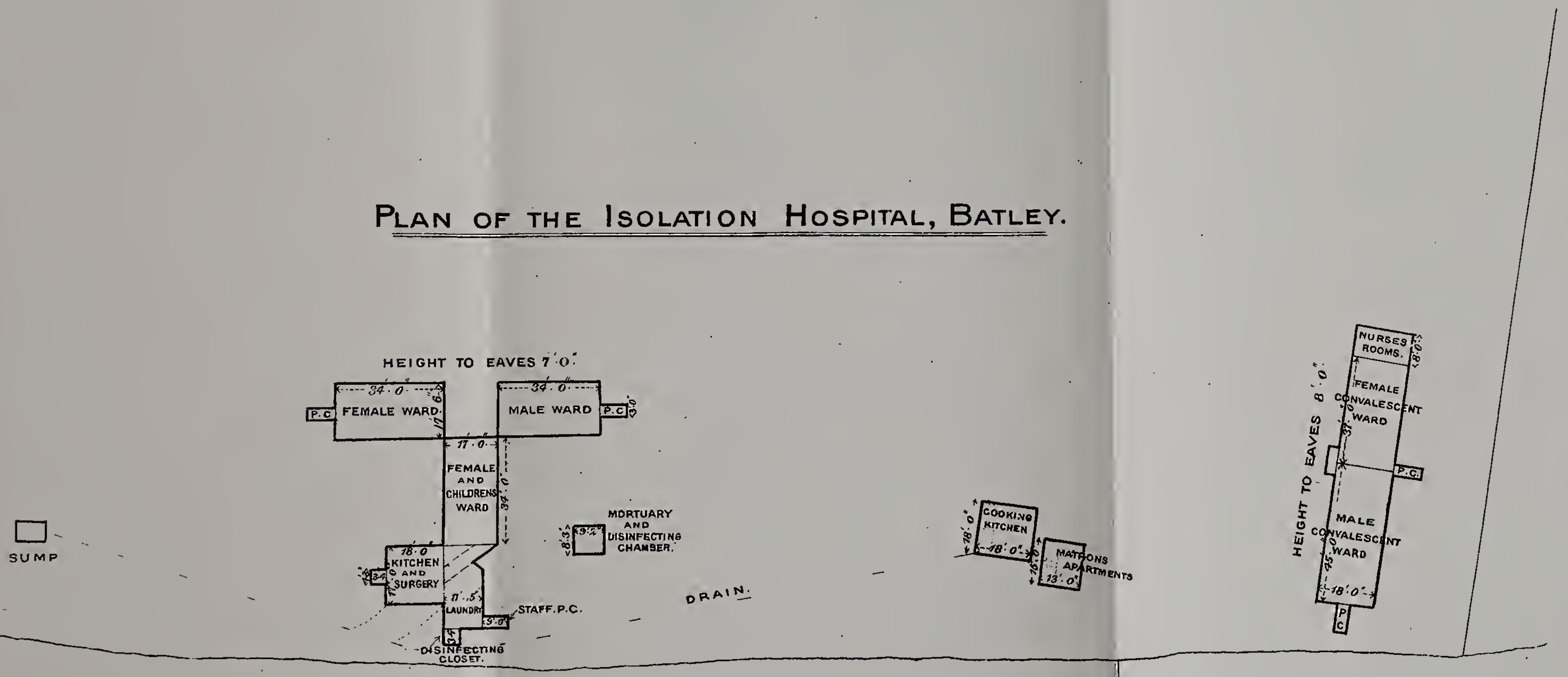
The measures taken by the Sanitary Authority with respect to infected houses varied according as to whether a case was removed to hospital or not. It will be seen later that a large proportion of cases were treated at their own homes, owing to the lack of hospital accommodation, a condition of things which became less and less as the epidemic advanced. From the end of December 1891 until about the middle of January 1892 the Corporation granted to each inmate of an infected house who was engaged in work the full amount of his or her wages on condition that they remained away from work so long as the house was infected, and did not frequent the public streets, or pay visits or go to public-houses, &c., &c., but they were not confined to the room. On January 11th the Town Council revised the scale of compensation allowed in these cases, granting in a family the sum of 7*s.* 6*d.* per week to the father, 7*s.* 6*d.* to the mother, and 2*s.* 6*d.* to each child, provided that the total amount did not exceed 30*s.* These sums were paid on conditions analogous to the former, with the stipulation that the case of small-pox should be isolated in a room, protected by a carbolised sheet over the door; and that no one but the medical man was allowed to enter the house. This plan continued until March 5th, by which time the hospital accommodation sufficed for all the cases that arose. If then a patient refused admission to hospital no compensation was given. There is no doubt that the attempt to strictly quarantine the people in their own homes was a very partial success. Some of them carried out the instructions literally, but several evaded them, and although not resuming work, went about elsewhere. Indeed, when the patient cannot be removed to an isolation hospital it must be impossible to enforce a rigid system of "quarantine" throughout the weeks that must elapse before that house can be declared free from infection.

Disinf tion.

When the patient had quite recovered the same measures of disinfection were adopted as took place on the removal of a patient to hospital, viz., the removal of clothing, bedding, &c., to the disinfecting station, sulphur-fumigation of the rooms, followed by papering, lime-whitening, and cleansing. Prior to March 1892 the Corporation had no disinfecting apparatus, and consequently compensation was paid (in kind generally) to those whose bedding had been destroyed. In March, however, there was available a steam and hot-air disinfector which had been erected at the sewage works from the plans of Mr. Illingworth, a member of the council, who, it may be remarked, adopts a similar method for the disinfection of rags at his mill. Mr. Fardon and myself paid a visit to this disinfector, with Mr. Lindley, and were met by Mr. Illingworth, who courteously demonstrated the construction and working of his apparatus. It consists (see Diagram) of an iron chamber set in brickwork, and lined with coils of steam pipe. It is closed at each end by a steel door so constructed as to permit of steam being passed into the chamber between the plates of which the door is made. There is also an

Illingworth's apparat

PLAN OF THE ISOLATION HOSPITAL, BATLEY.



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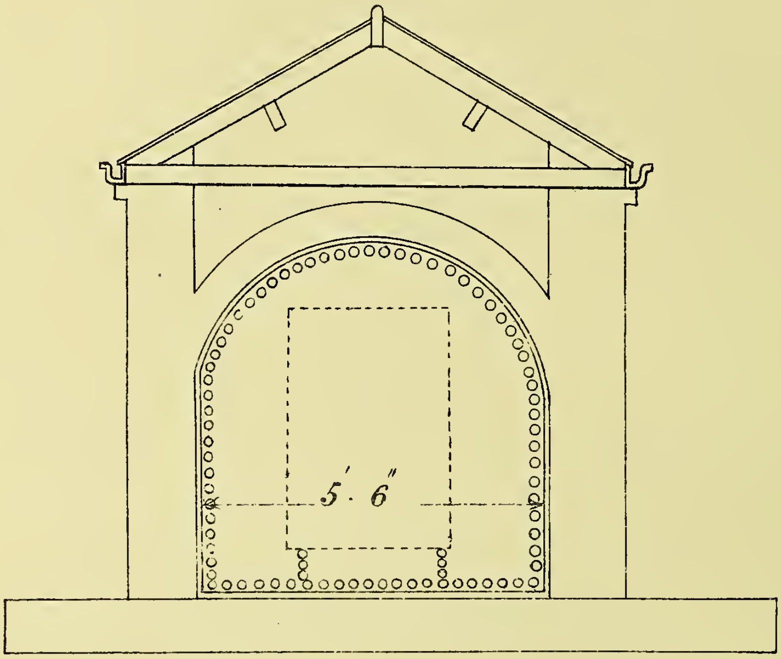
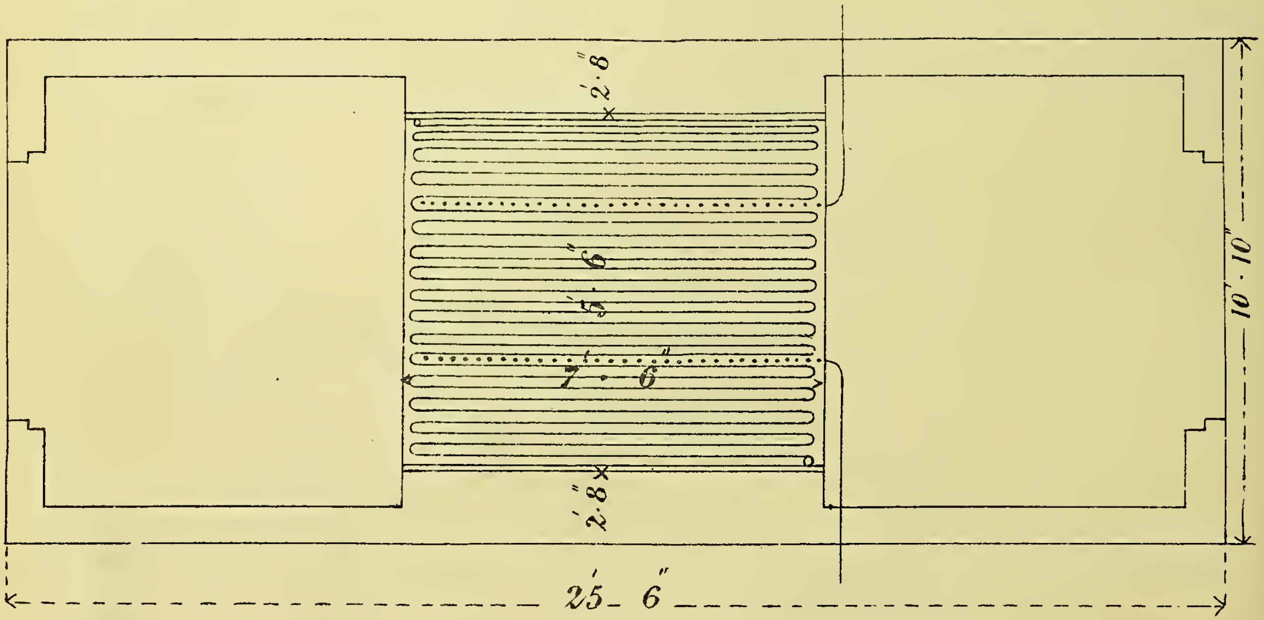
MR. J. ILLINGWORTH'S PATENT DISINFECTING APPARATUS IN USE AT BATLEY.





arrangement whereby jets of steam from a pipe running along the whole length of the floor can be forced into the chamber at will. The steam is supplied from the engine boiler connected with the sewage works and destructor, at a pressure of from 40 to 60 lbs. per square inch. In one experiment a dry heat in the chamber of 260° F. was obtained in 20 minutes, whilst a thermometer wrapped up in seven layers of an ordinary shawl registered 180° F. Steam was then admitted twice at intervals of five minutes, each time for a period of five minutes, and at the end of 20 minutes in all the heat was cut off. It was then found that whereas the temperature attained in the body of the chamber remained at 260° F., that registered by the thermometer in the shawl was 214° F. In each of these experiments the steam pressure was 60 lbs.

The ordinary procedure adopted is for the attendant to receive the infected clothing, &c., which is sent down a "shoot" from above into a carriage which runs on rails to the chamber. The attendant wears a macintosh coat and cap and follows this code of instructions:—

"1. Place cradle containing articles in the chamber.
2. Close up for 30 minutes.
3. Then turn on steam jet for five minutes.
4. Let it stand for 15 minutes.
5. Then turn on steam jet for five minutes.
6. Then let it stand for 30 minutes.
7. After which open the three air-valves for five minutes to clear chamber of any foul air before opening the outer door."

The articles are removed at the opposite end of the chamber to that at which they are introduced and conveyed away in a separate cart to that which is used to bring them to the place. All the arrangements for keeping infected articles separate from the disinfected and of providing access to the disinfector were highly satisfactory.

Re-vaccination of the inmates of infected houses, and the vaccination of those previously unvaccinated was advised by the medical attendants, but only carried out in a certain proportion of instances. Particulars on this point will be given hereafter; but the accompanying returns of the public vaccinations done during 1891 and the first four months of 1892, when the epidemic was at its height, may be given here (Table XI.).

The Dewsbury Union.

TABLE XI.

DEWSBURY UNION.

Batley District.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892, inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under One Year.	Between One and Two Years.	Two Years and upwards.	All Ages.
1891.—January - -	—	—	—	—
February - -	16	—	2	—
March - - -	19	1	—	—
April - - -	17	1	—	—
May - - -	11	3	3	—
June - - -	19	5	4	—
July - - -	35	1	3	—
August - - -	21	4	4	—
September - -	9	2	1	—
October - -	30	1	1	—
November - -	8	1	1	—
December - -	4	—	3	2
1892.—January - -	44	27	79	23
February - -	43	21	43	28
March - - -	37	15	20	3
April - - -	4	—	3	1
Totals - -	317	82	167	57

In pursuance of the plan adopted in the case of Dewsbury and with the object of conveying some idea as to the extent to which zymotic disease has prevailed of late years in these districts, I have been favoured by Dr. Swann with the following mortality statistics (Table XII.), which may be compared with those for the years 1873–77 cited by Dr. Thorne in his report:—

TABLE XII.

MORTALITY STATISTICS for the BOROUGH of BATLEY, for the years 1873–1892.

—	Estimated Population.	Total Deaths, all Causes.	"Fever."		Small-Pox.	Scarlet Fever.	Diphtheria.	Measles.	Diarrhœa, Dysentery, &c.
			Typhus.	Enteric.					
Mean for 1873–77 - -	24,957	605	19		5	50	?	?	39
1878 to 1883 - - - -	No returns available.								
1884 - - - - -	27,899	607	1	8		40	22	23	54
1885 - - - - -	28,020	573		7		13	21	15	14
1886 - - - - -	28,142	579		4		22	7	4	41
1887 - - - - -	28,463	645		10		8	14	52	42
Mean for 1884–87 - -	28,131*	601*	0·2*	7·2*		20·7*	16*	23·5*	37·7*
1888 - - - - -	28,385	511		6		12	7	4	18
1889 - - - - -	28,506	582		7		19	12	30	33
1890 - - - - -	28,627	584		10		1	4	10	33
1891 - - - - -	28,719(c)	701		12	13	8	7	18	20
1892 - - - - -	28,870	618		7	49	16	18†	4	17
Mean for 1888–92 - -	28,581	599		8·4	12·4	11·2	9·6	13·4	24·2

* Four years. † Including croup.

The Dewsbury Union.

So far as these statistics go they show a notable decline in the mortality from all forms of zymotic disease, excepting small-pox—and the mortality therefrom is confined to the last 2 years—since 1883. It is to be regretted there are no figures for the years 1878–83, as in Dewsbury during the first five of these years there were deaths from small-pox.

Morley.

Morley borough.

Morley, which became a borough in 1885, has a population (census 1891) of 18,725.

The town council is the sanitary authority, the medical officer of health being S. T. Steele, Esq., L.R.C.P., D.P.H., and the sanitary inspector, Mr. Joseph Ward.

The Notification of Infectious Diseases Act is not in force in the borough, but there is no reason to believe that any cases of small-pox escaped the notice of the medical officer.

The procedure as to disinfection, &c. is much the same as in other districts.

Temporary provision for isolation of small-pox.

When the first cases (two in one family) of small-pox occurred in Morley in 1891 there was no provision for their isolation within the borough. These patients were, therefore, admitted into the Small-pox Hospital at Leeds, and the rest of the family sent into quarantine at the Cemetery Lodge, a building which had been left vacant on the dissolution of the Burial Board in 1885 when the Corporation took over the cemetery. It occupies an elevated position and is some distance from inhabited dwellings. Consequently, when some months later small-pox reappeared and the borough was still without hospital accommodation, it was decided to utilise this building as a temporary hospital; and up to the time of my last visit (August 1892) it was still being employed for that purpose. Care was taken to lodge the patients in three rooms, capable of accommodating from 12 to 14 cases, on the side of the building away from the entrance to the cemetery. Every case as it arose was removed thither, and fortunately the outbreak was a comparatively mild and limited one. Suitable precautions were taken in the discharge of convalescent patients, as to bathing and change of clothing, and so far as known no cases have been traced to infection from this hospital.

Re-vaccination was almost invariably performed on inmates of houses in which cases of small-pox occurred.

The following is the return of the public vaccinations made in the Morley District during 1891 and the first four months of 1892:—

TABLE XIII.

DEWSBURY UNION.

Morley District.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892, inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under one Year.	Between one and two Years.	Two Years and upwards.	All Ages.
1891.				
January - - -	8	1	—	—
February - - -	16	1	—	—
March - - - -	9	2	—	—
April - - - -	8	—	—	—
May - - - -	13	1	—	—
June - - - -	15	2	—	—
July - - - -	12	3	—	—
August - - - -	14	—	—	—
September - - -	11	1	—	—
October - - -	10	1	—	—
November - - -	8	2	2	—
December - - -		—	—	—
1892.				
January - - -	8	1	3	3
February - - -	20	—	—	—
March - - - -	8	—	1	6
April - - - -	17	3	1	22
Totals - - -	181	18	7	31

The "zymotic history" of Morley for the past 20 years may be traced in the following statistics kindly furnished by Dr. Steele (Table XIV.). They show that scarlet fever and measles and diphtheria were unduly prevalent in the quinquennium, 1883–87, but that in other respects, here as elsewhere in the Dewsbury Union, the mortality from these diseases has notably decreased in spite of the increase of population.

TABLE XIV.

MORTALITY STATISTICS for the BOROUGH of MORLEY for the years 1873–93.

——	Estimated Population.	Total Deaths, all Causes.	"Fever."	Small-pox.	Scarlet Fever.	Diphtheria.	Measles.	Diarrhœa, Dysentery.
Mean 1873–77 -	10,715	288	7·2	7·4	24	?	?	10·2
1878 - - -	13,524	296	4	·	21	1	4	13
1879 - - -	14,065	270	2	·	7	2	6	5
1880 - - -	14,605	312	9	·	10	·	3	19
1881 - - -	15,011(c)	284	6	·	3	·	6	9
1882 - - -	15,475	341	7	·	·	·	26	21
Mean 1878–82 -	14,536	300	5·6	·	8·2	0·6	9	13·4
1883 - - -	15,846	305	7	·	5	1	1	5
1884 - - -	16,218	403	3	·	91	7	15	24
1885 - - -	16,589	296	2	·	15	4	·	5
1886 - - -	16,967	305	3	·	20	·	·	24
1887 - - -	17,332	360	3	·	20	1	44	22
Mean 1883–87 -	16,590	334	4	·	30·2	2·6	12	16
1888 - - -	17,703	310	·	·	1	2	·	7
1889 - - -	18,075	302	2	·	3	·	·	25
1890 - - -	18,446	341	2	·	·	1	23	9
1891 - - -	18,725(c)	377	5	·	3	1	9	9
1892 - - -	19,189	376	3	1	8	4	1	14
Mean 1888–92 -	18,467	341	2·4	0·2	3	1·6	6·6	12·8

Ossett.

The combined borough of Ossett-cum-Gawthorpe has a population of 10,984 (Census 1891), showing a very slight advance on the numbers returned in 1881. In his annual report for 1891, Mr. G. W. Greenwood, the late medical officer of health, writes on this point:—

"Some surprise was not unnaturally exhibited at the "small increase of population in Ossett during the past "decade, but the altered conditions of trade, which virtu- "ally drove away the male element in search of employment "no longer procurable here, the limited extent to which the "manufacture of woollen cloth was carried on (formerly the "noted and staple trade of Ossett), and the absence of "activity in other industries, are responsible for the present "state of things. Hundreds of non-resident women and "girls, denizens of adjoining parishes, hither come daily to "assist in carrying on work," and he expresses the opinion that extension of the collieries in the district will show a largely increased population at the next census.

The present medical officer of health is G. S. Greenwood, Esq., M.R.C.S., L.R.C.P., D.P.H., and the sanitary inspector, Mr. Hirst.

The town council form the sanitary authority.

The Notification of Infectious Diseases Act was adopted at the beginning of 1891 and has worked well.

The infectious disease hospital is a corrugated iron building with high-pitched roof standing in an exposed situation, facing west, on an escarpment 250 feet above sea level, near the southernmost boundary of the borough. It was erected in 1880 and shows evidence of considerable wear. I was informed that it was proposed shortly to erect a new building. The arrangement of the building, which is lofty and well lighted, is simple. A central corrider runs the length of the building terminating in a large ward, 45 feet by 15 feet, containing six beds and running transversely to the corridor. On the left hand of the latter is another ward (20 feet by 27 feet) containing 11 beds and a bath-room; on the right hand is the kitchen, nurses' room, sitting room for convalescents, and a surgery facing the bath-room.

Every case of small-pox has been taken to the hospital with promptitude, and the houses disinfected, bedding, &c. destroyed. Vaccination of other inmates of the house has been carried out in many cases.

Public vaccination has much declined of late years in the district, owing, I was informed, largely to the objection of parents to have more than "1 or 2 marks" made on the arms, and they prefer to pay for this than take their children to the vaccination stations to have "4 marks" made.

Ossett borough.

Table XV.

Dewsbury Union.

Ossett District.

Return as to Number of Vaccinations from 1st January 1891 to 30th April 1892 inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under One Year.	Between One and Two Years.	Two Years and upwards.	All Ages.
1891.				
January - - - -	—	—	—	—
February - - -	18	—	—	—
March - - - -	5	—	—	—
April - - - -	—	—	—	—
May - - - -	—	—	—	—
June - - - -	8	—	—	—
July - - - -	—	—	—	—
August - - - -	—	—	—	—
September - - -	18	1	—	—
October - - -	24	—	—	—
November - - -	7	—	—	—
December - - -	—	—	—	—
1892.				
January - - -	—	—	—	—
February - - -	9	—	3	—
March - - - -	10	—	1	—
April - - - -	4	—	—	—
Totals - -	103	1	4	—

Table XVI.

Mortality Statistics for the Borough of Ossett for the Years 1873–92.

—	Estimated Population.	Total Deaths.	"Fever."		Small-pox.	Scarlet Fever.	Diphtheria.	Measles.	Diarrhœa and Dysentery.	Whooping Cough.	Remarks.
			Typhus.	Enteric.							
Mean 1873-77 - - -	9,686	219	4·2		1·6	15	?	?	7·8	6	
1878 - - - - -	10,471	233	1	4	1	11	7	7		—	* Total from zymotic diseases.
1879 - - - - -	10,647	224	—	*	—	21	*	*	*	*	30
1880 - - - - -	10,824	214	—	*	—	11	*	*	*	*	26
1881 - - - - -	10,957 (c)	209	—	*	7	—	*	*	*	*	18
1882 - - - - -	10,960	235	—	1	2	1	3	10	7	2	—
Mean 1878-82 - - -	10,771	223	2	—	—	—	—	—	—	—	—
1883 - - - - -	10,963	193	—	1	1	9	3	—	4	1	
1884 - - - - -	10,965	193	—	2	—	6	—	—	8	1	Erysipelas 1, puerperal fever 1.
1885 - - - - -	10,968	190	—	—	—	20	1	9	—	5	
1886 - - - - -	10,971	165	—	—	—	3	—	1	5	1	
1887 - - - - -	10,973	216	—	2	—	5	—	3	7	1	
Mean 1883-87 - - -	10,968	191	—	1	0·2	8·6	0·8	2·6	4·8	1·8	
1888 - - - - -	10,976	183	—	—	—	2	1	1	1	1	
1889 - - - -	10,979	166	—	—	—	1	3	4	6	—	Erysipelas 1, Croup 1.
1890 - - - - -	10,982	245	—	—	—	6	—	—	2	9	Erysieplas 2, Croup 3.
1891 - - - - -	10,984 (c)	217	—	2	—	2	1	2	—	—	
1892 - - - - -	10,987	181	—	3	1	7	1	—	3	1	
Mean 1888-92 - - -	10,981	198	—	1	0·2	3·6	1·2	1·4	2·4	2·2	

The Dewsbury Union.

The appended table (XVI.) of mortality statistics shows that there is a continued decrease in the zymotic death-rate. Mr. J. W. Greenwood's remarks on this head, in the annual report aboved cited, are of interest:—

"Notwithstanding the severe scourge of influenza with which we had to contend, and which exercised a very baneful influence, largely augmented the death list, and leaving behind it serious after consequences, it is satisfactory to find that the total number of deaths from all causes is considerably below that of the previous year. The zymotic death-rate fell to a low point, being only 1·09, or almost half the average of England and Wales. Diarrhœa was entirely absent. Measles prevailed extensively during the second quarter of the year, but as a rule was of a mild type, and only occasioned two deaths. One-fourth of the deaths was due to disease of the respiratory organs; pneumonia of a low and malignant character proving very fatal."

The remaining urban sanitary districts of the Dewsbury Union in which small-pox occurred during the period covered by this inquiry are Birstal, Heckmondwike, Liversedge, Mirfield, Ravensthorpe, Soothill Nether, Soothill Upper, and Thornhill.

Each of these is administered by a local board, and in none of them was there any special isolation hospital established.

Birstal.

Birstal.

The population of Birstal in 1891 was 6,528—a falling off of 240 persons since the previous census.

The Medical Officer of Health is R. Forsyth, M.D., and the sanitary inspector, Mr. J. Blackburn.

Notification of infectious disease came into operation on March 1st, 1892.

Some of the cases of small-pox were treated in their own homes, others sent to the Batley Hospital, which is situated close to the boundary of Birstal.

The usual methods of disinfection of the houses inhabited by cases of small-pox were carried out, the bedding of the patient being removed and destroyed, and renewed at the expense of the Local Board.

Re-vaccination was performed by Dr. Forsyth on members of infected houses, calf-lymph being usually preferred.

I append the returns of public vaccination in this district in 1891, and the first few months of 1892; and also the mortality statistics for the 18 years, 1875–92 (Tables XVIII. and XIX.):—

TABLE XVII.

DEWSBURY UNION.

Birstal District.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892, inclusive.

Month.	Primary Vaccinations.			Revaccinations.
	Under One Year.	Between One and Two Years.	Two Years and upwards.	All Ages.
1891.—January - -	—	—	—	—
February - -	—	—	—	—
March - - -	10	—	—	—
April - - -	9	—	—	—
May - - -	12	1	1	—
June - - -	40	1	3	—
July - - -	22	—	4	—
August - - -	7	3	1	—
September - -	27	2	—	—
October - -	13	2	1	—
November - -	23	3	1	—
December - -	10	—	—	—
1892.—January - -	2	—	2	7
February - -	13	—	1	
March - - -	14	—	—	—
April - - -	8	1	—	—
Totals - -	210	13	14	5

TABLE XVIII.

MORTALITY STATISTICS for the URBAN SANITARY DISTRICT of BIRSTAL, 1875–92.

—	Estimated Population.	Total Deaths, all Causes.	"Fever."		Small-pox.	Scarlet Fever.	Diphtheria.	Measles.	Diarrhœa and Dysentery.
			Tpyhus.	Enteric.					
Mean 1875–77 - -	6,944	136	3·7			5	?	?	2·3
1878 - - - -	6,566	167	·	3	·	16	2	3	·
1879 - - - -	6,638	155	·	6	·	5	1	2	8
1880 - - - -	6,710	159	·	1	·	2	·	7	
1881 - - - -	6,766 (c)	120	1	4	·	1	·	·	2
1882 - - - -	6,736	143	·	5	1	6	·	1	2
Mean 1878–82 - -	6,683	149	0·2	3·8	0·2	6	0·6	2·6	2·4
1883 - - - -	6,712	165	·	·	·	6	2	·	1
1884 - - - -	6,688	150	·	4	1	10	2	1	12
1885 - - - -	6,654	146	·	1	·	·	2	3	1
1886 - - - -	6,631	138	·	1	·	6	·	·	1
1887 - - - -	6,607	146	·	·	·	2	1	7	·
Mean 1883–87 - -	6,658	149	·	1·2	0·2	4·8	1·4	2·2	3
1888 - - - -	6,593	120	·	·	·	·	4	·	·
1889 - - - -	6,569	140	·	·	·	1	·	4	·
1890 - - - -	6,545	118	·	1	·	·	·	3	1
1891 - - - -	6,528(c)	169	·	2	·	·	·	5	1
1892 - - - -	6,498	117	·		·	1	*	7	1
Mean 1888–92 - -	6,546	133		0·6		0·4	0·8	3·8	0·6

* Croup 1.

Heckmondwike.

The population of this district in 1891 was 9,709, being an increase of 427 since the previous census.

The Medical Officer of Health is H. T. Broughton, Esq., M.R.C.S., and the sanitary inspector, Mr. T. Gledhill.

The procedure adopted in cases of small-pox infection is similar to that obtaining elsewhere. Some of the cases were treated in their own homes, others removed to the Dewsbury Hospital, and two of the earliest cases to the union infirmary at Staincliffe.

The vaccination returns for 16 months ending April 1892 are appended (Table XIX), but I am unable to give any mortality statistics as in the case of most of the other districts.

TABLE XIX.

DEWSBURY UNION.

Heckmondwike District.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892, inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under One Year.	Between One and Two Years.	Two Years and upwards.	All Ages.
1891.—January - -	2	—	—	—
February - -	—	—	—	—
March - -	—	—	—	—
April - - -	5	—	1	—
May - - -	—	—	—	—
June - - -	—	—	—	—
July - - -	7	—	—	—
August - - -	2	—	—	—
September - -	—	—	—	—
October - -	17	8	7	—
November - -	1	—	—	—
December - -	—	—	—	—
1892.—January - -	7	—	—	—
February - -	1	—	—	—
March - - -	—	—	—	—
April - - -	6	1	5	6
Totals - -	48	9	13	6

Liversedge.

The Dewsbury Union. Liversedge.

This district, which adjoins Heckmondwike, but is far less densely peopled, has a total population of 13,668 (1891), being an increase over the population in 1881 of 911 persons.

The Medical Officer of Health is J. Shives, M.D., and the sanitary inspector, Mr. W. Houldershaw.

Compulsory notification came into force on February 1, 1892.

Most of the cases of small-pox here arising were treated in their own homes, but every precaution was taken to avoid the spread of the disease, the inmates of infected houses being in most cases promptly vaccinated.

Appended are the vaccination returns for the 16 months ending April 1892 (Table XX.), and the mortality statistics (so far as available), for the 18 years, 1875 to 1892 (Table XXI) :—

TABLE XX.

DEWSBURY UNION.

Liversedge District.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892 inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under One Year.	Between One and Two Years.	Two Years and upwards.	All Ages.
1891. January -	8	2	—	1
February - - -	—	—	—	—
March - - -	1	—	—	—
April - - - -	54	2	—	—
May - - - -	—	—	—	—
June - - - -	—	—	—	—
July - - - -	40	4	2	—
August - - - -	—	—	—	—
September - - -	—	—	—	—
October - - -	41	8	—	—
November - - -	—	—	—	—
December - - -	—	—	—	—
1892. January - - -	30	2	7	7
February - - -	5	—	3	13
March - - - -	1	—	—	17
April - - - -	55	7	2	—
Totals - - -	235	25	14	38

TABLE XXI.

MORTALITY STATISTICS for the URBAN SANITARY DISTRICT of LIVERSEDGE, 1875–92.

—	Estimated Population.	Total Deaths.	"Fever."		Small-pox.	Scarlet Fever.	Diphtheria.	Measles.	Diarrhœa and Dysentery.
			Typhus.	Enteric.					
Mean 1875–77 - -	12,567	282	5	—	—	18·3	?	?	12·7
1878 - - - -	12,302	280	No return		—	Noreturn	—	4	17
1879 - - - -	12,467	261	"		—	"	—	—	5
1880 - - - -	12,632	299	—	—	—	—	—	8	19
1881 - - - -	12,757 (c)	268	—	5	—	8	—	3	8
1882 - - - -	12,870	215	1	1	—	5	5	1	6
Mean 1878–82 - -	12,565	261	0·3	2		4·3	2·6	4	11
1883 - - - -	12,962	223	2	4	—	—	—	—	2
1884 - - - -	13,053	240	—	6	—	—	—	4	10
1885 - - - -	13,144	242	1	2	—	13	—	—	1
1886 - - - -	13,235	196	—	2	—	2	—	2	4
1887 - - - -	13,326	222	—	1	—	4	—	3	8
Mean 1883–87 - -	13,144	224	0·6	3	—	3·8	—	1·8	4·6
1888 - - - -	13,417	241	—	1	—	1	—	1	—
1889 - - - -	13,508	237	—	—	—	—	—	5	8
1890 - - - -	13,599	217	—	—	—	2	1	1	3
1891 - - - -	13,688 (c)	342	—	4	—	3	3	3	2
1892 - - - -	13,782	261	—	2	1	5	—	1	3
Mean 1888–92 - -	13,600	259	—	1·4	0·2	2·2	0·8	2·2	3·2

Mirfield.

The Dewsbury Union. Mirfield.

This is a large thinly-populated district, the total population being 11,707, an increase of 199 persons since 1881 census.

The Medical Officer of Health is T. B. Fairclough, Esq. L.R.C.P., and the sanitary inspector, Mr. W. Booth.

The usual precaution of removal and destruction of infected bedding, and of fumigation of rooms and houses after removal of the case of small-pox were carried out.

The cases were removed to the Batley Small-pox Hospital, a distance of four or five miles.

The following table (XXII.) gives the number of public vaccinations performed in the 16 months ending April 1892.

Ravensthorpe.

Ravensthorpe.

This district, the smallest in the Union, is more densely populated than any other except Dewsbury. It had a total population of 5,134 in 1891, an increase of 770 since 1881.

The Medical Officer of Health is W. J. Richardson, M.D., and the sanitary inspector, Mr. Hemingway.

The Notification Act was adopted in March 1890.

The cases of small-pox were removed to the Dewsbury Hospital, which is situated close to the boundary of Ravensthorpe. Disinfection was prompt and thorough, and in some cases re-vaccination of inmates of infected houses was performed.

At my visit I had the opportunity of seeing the sewage works in which lime-precipitation is used, the effluent being run on to the land. I was informed that since the introduction of a thorough drainage system, the death rate in this low-lying district has materially fallen. The chief items in the mortality are to be found in the accompanying table (XXIII.) :—

TABLE XXII.

DEWSBURY UNION.

Mirfield District.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892, inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under One Year.	Between One and Two Years.	Two Years and upwards.	All Ages.
1891.—January - -	2	—	—	—
February - -	1	—	—	—
March - - -	6	2	—	—
April - - -	12	4	3	—
May - - -	4	—	—	—
June - - -	16	—	—	—
July - - -	12	—	—	—
August - - -	4	—	2	—
September - -	15	3	3	—
October - -	13	7	5	—
November - -	1	2	1	—
December - -	—	—	—	—
1892.—January - -	—	—	—	—
February - -	1	—	1	—
March - - -	4	—	1	18
April - - -	—	—	—	—
Total - -	91	18	16	18

TABLE XXIII.

MORTALITY STATISTICS OF THE URBAN SANITARY DISTRICT OF RAVENSTHORPE, 1875–92.

——	Estimated Population.	Total Deaths.	" Fever."		Small-Pox.	Scarlet Fever.	Diphtheria.	Measles.	Diarrhœa and Dysentery.
			Typhus.	Enteric.					
Mean 1875–77 - -	3,772	73	2·3		1	—	?	?	3
1878 - - - -	3,964	61	—	1	—	6	—	—	3
1879 - - - -	4,109	69	—	1	—	3	—	—	—
1880 - - - -	4,255	118	—	—	—	3	—	2	—
1881 - - - -	4,364 (c)	68	—	1	—	1	—	—	2
1882 - - -	4,460	85	—	1	—	—	—	4	—
Mean 1878–92 - -	4,250	80	—	0·8	—	2·6	—	1·2	1·
1883 - - - -	4,537	61	—	—	—	—	—	—	—
1884 - - - -	4,614	66	—	—	—	1	1	—	3
1885 - - - -	4,691	66	—	—	—	1	1	4	—
1886 - - - -	4,768	98	—	4	—	6	—	1	4
1887 - - - -	4,845	112	—	2	—	—	1	12	2
Mean 1883–87 - -	4,691	80	—	1·2	—	1·6	0·6	3·4	1·8
1888 - - - -	4,922	65	—	1	—	4	—	2	1
1889 - - - -	4,999	112	—	—	—	1	—	5	2
1890 - - - -	5,076	98	—	2	—	—	—	2	4
1891 - - - -	5,130 (c)	94	—	—	—	1	—	1	—
1892 - - - -	5,230	118	—	1	—	2	—	—	2
Mean 1888–92 - -	5,072	97	—	0·8	—	1·6	—	2·	1·8

Soothill Nether.

This district, which extends between Dewsbury and Ossett, and Soothill Upper, is somewhat densely populated, The Census of 1891 showed its population to be 5,848, an increase of 608 since 1881.

The Medical Officer of Health is C. Clay, Esq., M.R.C.S., and the Sanitary Inspector Mr. H. Scott.

Most of the cases of small-pox were sent to the Dewsbury Hospital, and prompt measures taken to disinfect bedding, clothing, and rooms inhabited by the patients.

Re-vaccination of several of the inmates was effected.

The returns of public vaccination during the 16 months ending April 1892 are appended (Table XXIV.).

TABLE XXIV.

DEWSBURY UNION.

Soothill Nether District.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892, inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under One Year.	Between One and Two Years.	Two Years and upwards.	All Ages.
1891.—January - -	—	—	—	—
February - -	—	—	—	—
March - - -	—	—	—	—
April - - -	8	—	1	—
May - - -	—	—	—	—
June - - -	—	—	—	—
July - - -	1	—	—	—
August - - -	—	—	—	—
September - -	—	—	—	—
October - -	13	2	1	—
November - -	—	—	—	—
December - -	—	—	—	—
1892.—January - -	—	—	—	—
February - -	—	—	—	—
March - - -	—	—	—	—
April - - -	1	—	—	—
Totals - -	23	2	2	—

Soothill Upper.

The Dewsbury Union.

Soothill Upper.

This is a large, wide, high-lying district—the population being grouped in the three centres of the "Leeds Road," close to Dewsbury, Hanging Heaton, above Batley Carr, and Soothill Lane. The total population in 1891 was 5,645, being an increase on the preceding census of 490.

The Medical Officer of Health at the time of my visit was T. Laird, Esq., M.D., the Sanitary Inspector. Mr. W. Tully.

Some of the cases of small-pox were treated in their own homes; others removed to Batley Small-pox Hospital.

The usual procedure of disinfection, &c. was promptly carried out.

I append tables (XXV. and XXVI.) of the public vaccinations in 1891–92, and of mortality statistics (so far as available) for 1875–92.

TABLE XXV.

DEWSBURY UNION.

Soothill Upper District.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892, inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under One Year.	Between One and Two Years.	Two Years and upwards.	All Ages.
1891.—January - -	5	—	—	—
February - -	—	—	—	—
March - - -	—	—	—	—
April - - -	10	—	2	—
May - - -	—	—	—	—
June - - -	—	—	—	—
July - - -	8	2	1	—
August - - -	—	—	—	—
September - -	—	—	—	—
October - -	2	5	—	—
November - -	—	—	—	—
December - -	—	—	—	—
1892.—January - -	5	—	—	—
February - -	—	—	—	—
March - - -	—	—	—	—
April - - -	3	—	6	—
Totals - -	33	7	9	—

TABLE XXVI.

MORTALITY STATISTICS for the URBAN SANITARY DISTRICT of SOUTHILL UPPER, 1875–77 and 1883–92.

———	Estimated Population.	Total Deaths.	"Fever."		Small-pox.	Scarlet Fever.	Diphtheria	Measles.	Diarrhœa and Dysentery.
			Typhus.	Enteric.					
Mean 1875–77 - -	4,093	100	4		1	6·6	?	?	4·3
1878 to 1882 - - -	—	No return.		—	—	—	—	—	—
1883 - - - -	5,265	93	—	1	—	2	—	—	—
1884 - - - -	5,314	104	1	1	—	2	—	—	—
1885 - - - -	5,363	104	—	1	—	2	1	—	—
1886 - - - -	5,412	81	—	1	—	2	—	1	3
1887 - - - -	5,561	124	—	1	—	1	—	6	—
Mean 1883–87 - -	5,363	101	0·2	1	—	1·8	1·2	1·4	0·6
1888 - - - -	5,510	92	—	2	—	4	—	—	—
1889 - - - -	—	No return		—	—	—	—	—	—
1890 - - - -	5,608	104	—	2	—	1	1	3	6
1891 - - - -	5,645 (c)	117	—	1	—	1	—	4	1
1892 - - - -	5,706	119	—	5	1	4	2	—	1
Mean 4 years - -	5,617	108	—	2·5	0·5	2·5	0·7	1·7	2

The Dewsbury Union.

Thornhill.

Thornhill.

This is a wide district, south of Dewsbury, and consisting of partly low ground in the Calder Valley (Saville Town) and partly high ground (Thornhill Lees and Thornhill). Its population in 1891 was 9,606, an increase of 763 since 1881.

The Medical Officer of Health is H. E. Davies, Esq., L.R.C.P., and the sanitary inspector Mr. J. Hampshire.

Compulsory notification is not in force in the district.

The cases of small-pox were sent to the Dewsbury Hospital, and prompt disinfection of houses carried out.

Re-vaccination of inmates of infected houses was performed in some instances but not in all.

The returns of public vaccination for 1891 and the first four months of 1892 are appended (Table XXVII.); and also the mortality statistics from zymotic disease for the 20 years 1873–92.

TABLE XXVII.

DEWSBURY UNION.

Thornhill and Whitley District.

RETURN as to NUMBER of VACCINATIONS from 1st January 1891 to 30th April 1892 inclusive.

Month.	Primary Vaccinations.			Re-vaccinations.
	Under One Year.	Between One and Two Years.	Two Years and upwards.	All Ages.
1891.—January - -	—	—	—	—
February - -	—	—	—	—
March - - -	—	—	—	—
April - - -	13	3	—	—
May - - -	1	2	—	—
June - - -	2	—	—	—
July - - -	3	—	—	—
August - -	2	—	1	—
September - -	8	7	—	—
October - -	10	1	1	—
November - -	3	2	—	—
December - -	—	1	—	—
1892.—January - -	1	—	—	—
February - -	5	1	2	—
March - - -	4	1	5	—
April - - -	6	—	—	—
Totals - -	58	18	9	—

TABLE XXVIII.

MORTALITY STATISTICS for the URBAN SANITARY DISTRICT of THORNHILL, 1873–92.

—	Estimated Population.	Total Deaths.	"Fever."		Small-pox.	Scarlet Fever.	Diphtheria.	Measles.	Diarrhœa and Dysentery
			Typhus.	Enteric.					
Mean 1873–77 - -	8,013	147	6		1	5·6	?	?	3·4
1873 - - - -	8,145	190	—	4	—	22	—	1	3
1879 - - - -	8,399	167	—	5	—	7	—	1	—
1880 - - - -	8,652	175	—	5	—	3	1	1	—
1881 - - - -	8,843 (c)	148	—	—	—	—	—	1	1
1882 - - - -	8,938	173	—	3	1	2	—	3	1
Mean 1878–82 - -	8,595	170	—	3·4	0·2	6·8	0·2	1·4	1
1883 - - - -	9,014	104	"4 deaths from zymotic diseases."						
1884 - - - -	9,090	188	—	3	—	3	—	—	13
1885 - - - -	9,167	134	—	3	—	1	—	8	2
1886 - - - -	9,243	145	—	3	—	—	—	3	6
1887 - - - -	9,320	155	—	6	—	7	—	3	--
Mean 1883–87 - -	9,167	155	—	3·7*	—	2·7*	—	3·5	5·2
1888 - - - -	9,396	Returns not complete.							
1889 - - - -	9,472	169	—	—	—	1	—	12	3
1890 - - - -	9,548	181	—	5	—	—	—	1	8
1891 - - - -	9,606 (c)	168	—	1	—	—	1	1	4
1892 - - - -	9,700	142	—	—	1	1	—†	—	3
Mean 1889–92 - -	9,540	165	—	1·5	0·2	0·5	0·2	3·5	4·5

* Four years. † Croup 1.

PART II.

Period covered by Report :—April 1891 *to August* 1892. *Relative prevalence of small-pox during this period in the Dewsbury Union, and other districts of West Riding. Monthly incidence in the several districts of the Dewsbury Union. Weekly incidence. Cases arising at Union Workhouse. Number of infected houses and cases proceeding therefrom in each month. Number of such houses visited, and their inmates. Analysis of size of households and of cases (single or multiple) occurring therein. Sex and age incidence. Incidence of the disease on those* (*a*) *engaged at home,* (*b*) *attending school,* (*c*) *engaged at work from home. Types of small-pox and mortality. Numbers and ages of those treated at home or isolated in hospital.*

PART II.—GENERAL HISTORY OF OUTBREAK.

e of t case.

The first case of small-pox known to have arisen in the epidemic in the Dewsbury Union of 1891-2, was that of a rag sorter, residing at Batley, whose illness commenced on April 30, 1891. At that date, the West Riding of Yorkshire was, and had been for some 3 years, i.e., since the abatement of the extensive epidemic in Sheffield in 1888, practically free from the disease. I am unable to state positively that there was no small-pox in each of the sanitary districts of the Riding, but the monthly reports of the Medical Officer to the County Council which commence in April 1891, give no cases for the districts then furnishing returns.

or case Leeds.

The only other case occurring in the West Riding at this date that is known to me, was at Leeds, the first of a series of 48 cases that arose in that borough during 1891. This man, although a recent arrival in Leeds, was probably infected in that borough, for he fell ill on April 14th, about 20 days after his arrival. All inquiries were made at the time by Dr. Spottiswoode Cameron to trace the source of his infection, but without success, the only possible clue being a visit to a tailor's shop, which he made on March 31st. No other case prior to or subsequent to this, was traceable to the same source.*

thly valence.

The period covered by the present inquiry, viz., 70 weeks, from the week ending May 2nd, 1891, to the week ending August 27th, 1892, was marked by a far greater prevalence of small-pox in the Dewsbury Union, than in any other district of the West Riding. This is clearly shown by the following table which has been prepared (as regards all other than the Dewsbury district), from the notification returns furnished monthly to the County Council Medical Officer. I have collected the figures given under each district of the Halifax Union, which adjoins the Dewsbury Union and was the seat of a somewhat severe outbreak in the early summer of 1892, at a time when the disease was on the decline in the former area.

Month.	Dewsbury Union.	Halifax Union.	Other Districts of West Riding.	County Boroughs.			
				Leeds.	Bradford.	Halifax.	Sheffield.
1891.							
April	1	—	—	2	—	—	—
May	5	—	—	1	—	—	—
June	16	—	—	2	—	—	—
July	13	—	—	6	—	—	—
August	13	—	1	21	—	—	—
September	8	—	3	15	—	—	—
October	6	—	4	—	—	—	—
November	13	—	—	—	—	—	—
December	83	—	2	1	—	—	—
1892.							
January	219	1	21	1	—	—	—
February	198	1	14	1	—	—	—
March	156	—	25	1	—	2	1
April	112	2	28	3	—	2	2
May	78	104	62	—	1	5	7
June	44	54	60	—	2	24	2
July	38	31	44	6	4	16	14
	1,003	193	264	60	7	49	26

General sketch of outbreak.

The accompanying series of maps indicate the sanitary districts of West Riding, in which cases of small-pox are known to have occurred in each of the 17 months, April 1891 to August 1892. The scale of the map has only permitted of the boundaries of the several unions to be delineated ; the red dots indicate urban sanitary districts ; the open circles rural sanitary districts. The following list may serve as a key to the maps :—

Monthly prevalence in districts of West Riding.

Month.	Union.	Urban Sanitary Districts.	Rural Sanitary District.
1891. April	Dewsbury	Batley.	
	Leeds	Leeds.	
May	Dewsbury	Batley, Ossett.	
	Leeds	Leeds.	
June	Dewsbury	Batley, Birstal, Dewsbury, Heckmondwike, Soothill Upper.	
	Leeds	Leeds.	
July	Dewsbury	Batley, Dewsbury.	
August	"	" "	
	Leeds	Leeds.	
	Pontefract	Pontefract.	
September	Barnsley	- - - -	Barnsley.
	Dewsbury	Batley, Dewsbury.	
	Leeds	Leeds.	
	Pateley Bridge.	- - - -	Pateley Bridge.
	Wakefield	Wakefield.	
October	Dewsbury	Dewsbury.	
	Hunslet	Rothwell.	
	Wakefield	Wakefield - -	Wakefield.
November	Dewsbury	Batley, Dewsbury, Ossett, Ravensthorpe.	
December	Dewsbury	Batley, Birstal, Dewsbury, Thornhill.	
	Leeds	Leeds.	
	Wakefield	Wakefield.	
1892. January	Barnsley	Barnsley.	
	Dewsbury	Batley, Birstal, Dewsbury, Heckmondwike, Liversedge, Morley, Soothill Nether, Soothill Upper, Thornhill.	
	Halifax	- - - -	Halifax.
	Huddersfield	Glaithwaite (Colne Valley).	
	Leeds	Leeds.	
	North Bierley.	Drighlington.	
	Pateley Bridge.	- - - -	Pateley Bridge.
	Pontefract	Pontefract.	
	Wakefield	Wakefield - -	Wakefield.
February	Barnsley	Barnsley, Wombwell -	Barnsley
	Bramley	Gildersome.	
	Dewsbury	Batley, Birstal, Dewsbury, Heckmondwike, Liversedge, Mirfield, Ossett, Ravensthorpe, Soothill Nether, Soothill Upper, Thornhill.	
	Halifax	Ovenden.	
	Huddersfield	Meltham.	
	Leeds	Leeds.	
	North Bierley.	Drighlington.	
	Pateley Bridge.	- - - -	Pateley Bridge.
	Wakefield	- - - -	Wakefield.
	Wortley	Stocksbridge.	
March	Barnsley	- - - -	Barnsley.
	Dewsbury	Batley, Birstal, Dewsbury, Heckmondwike, Mirfield, Morley, Ravensthorpe, Soothill Nether, Soothill Upper, Thornhill.	
	Halifax	Halifax.	
	Huddersfield.	Meltham.	

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* Annual Report of the Medical Officer of Health for the Borough of Leeds. 1891.

General sketch of outbreak.

Month.	Union.	Urban Sanitary Districts.	Rural Sanitary District.
1892. March	Leeds	Leeds.	
	Sheffield	Sheffield.	
	Wakefield	Wakefield	Wakefield.
	Wortley	Stocksbridge.	
April	Dewsbury	Batley, Birstal, Dewsbury, Heckmondwike, Liversedge, Mirfield, Morley, Ossett, Ravensthorpe, Soothill Nether, Soothill Upper, Thornhill.	
	Doncaster	- - - -	Doncaster.
	Halifax	Halifax	Halifax.
	Huddersfield.	Huddersfield, Meltham.	
	Hunslet	- - - -	Hunslet.
	Leeds	Leeds.	
	North Bierley.	North Bierley, Cleckheaton.	
	Sheffield	Sheffield.	
	Wakefield	Wakefield	Wakefield.
	Wortley	Stocksbridge.	
May	Bradford	Bradford.	
	Dewsbury	Batley, Dewsbury, Heckmondwike, Morley, Ossett, Ravensthorpe, Soothill Nether, Soothill Upper, Thornhill.	
	Doncaster	- - - -	Doncaster.
	Halifax	Halifax, Brighouse, Hipperholme, Rastrick.	Halifax.
	Huddersfield	Huddersfield.	
	Hunslet	Rothwell	Hunslet.
	Keighley	Keighley.	
	North Bierley.	North Bierley, Cleckheaton, Drighlington.	
	Penistone	- - - -	Penistone, 1st Div.
	Sheffield	Sheffield.	
	Wakefield	Wakefield	Wakefield.
	Wortley	Stocksbridge.	
June	Barnsley	- - - -	Barnsley.
	Bradford	Bradford.	
	Dewsbury	Batley, Dewsbury, Heckmondwike, Liversedge, Morley, Ossett, Ravensthorpe, Soothill Nether, Soothill Upper, Thornhill.	
	Doncaster	Mexboro'	Doncaster.
	Halifax	Brighouse, Hipperholme, Queensferry, Rastrick, Sowerby Bridge, Halifax.	Halifax.
	Huddersfield	Holmfirth.	
	North Bierley.	Cleckheaton, North Bierley.	
	Penistone	Thurlstone.	
	Pontefract	Knottingley.	
	Rotherham	Swinton.	
	Sheffield	Sheffield.	
	Wakefield	Wakefield	Wakefield.
	Wortley	Stocksbridge.	
July	Bradford	Bradford.	
	Dewsbury	Batley, Dewsbury, Heckmondwike, Liversedge, Morley.	
	Doncaster	- - - -	Doncaster.
	Goole	Goole.	
	Halifax	Brighouse, Greetland, Queensbury, Rastrick, Southowram, Sowerby Bridge, Halifax.	Halifax.
1892. July	Huddersfield	Marsden (Colne Valley).	
	Knaresboro'	Knaresboro'.	
	Leeds	Leeds.	
	North Bierley.	Drighlington, North Bierley.	
	Pontefract	Knottingley.	
	Sheffield	Handsworth, Sheffield.	
	Wakefield	Normanton, Wakefield	Wakefield.
	Wharfdale	Otley.	
	Wortley	Stocksbridge.	
August	Barnsley	Barnsley.	
	Bradford	Bradford.	
	Dewsbury	Dewsbury, Heckmondwike, Mirfield, Morley, Ossett, Ravensthorpe, Thornhill.	
	Doncaster	Mexboro'.	
	Halifax	Brighouse, Sowerby Bridge.	Halifax.
	Leeds	Leeds.	
	North Brierley.	Cleckheaton, Drighlington.	
	Pateley Bridge.	- - - -	Pateley Bridge.
	Penistone	Penistone, Thurlstone.	
	Sheffield	Handsworth.	
	Todmorden	Mytholomroyd.	
	Wakefield	Horbury, Normanton, Sandal, Wakefield.	

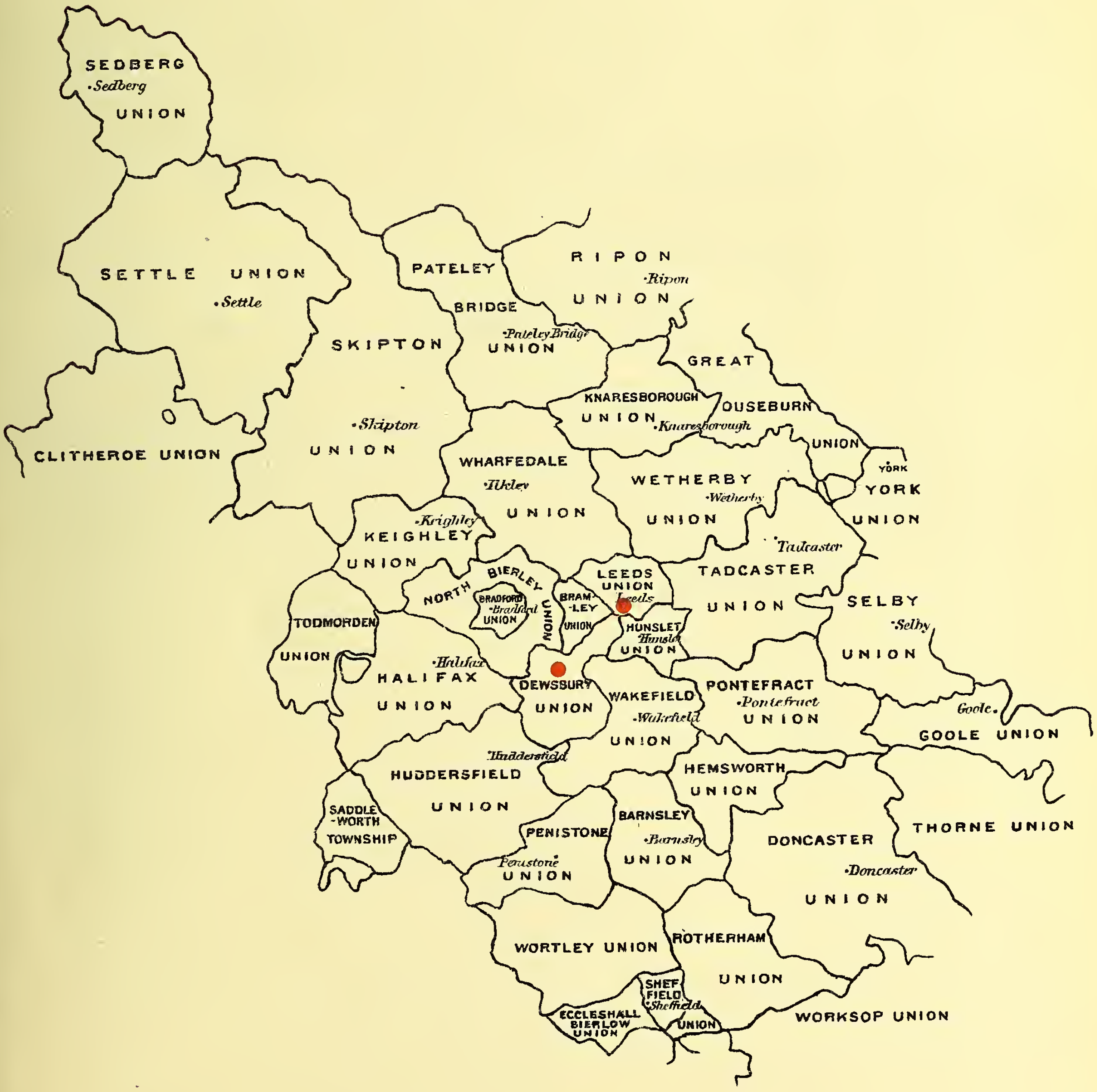
Reverting now to the outbreak within the Dewsbury Union, I propose, in the first place, to give a general account of this, and afterwards to deal with the epidemic in each of the 13 districts that were invaded.

Monthly distribut in Dewsbury Uni

The total number of cases occurring within the period named (70 weeks), was 1,029, and as the annexed table (Table XXIX.) and diagrams (Plans A., B., and C.) show the distribution throughout the union varied from month to month. Thus, as already said, one case occurred in Batley in *April* 1891; in *May* there was, in addition to cases in Batley, one in Ossett. In *June*, one case in Birstal, Heckmondwike and Soothill Upper respectively, as well as in Batley and Dewsbury. Cases continued to arise in Batley and Dewsbury during *July, August* and *September*, but it may be observed that the disease had practically died out in Batley. Indeed, save for two children in one family attacked in the middle of September, Batley enjoyed an immunity from it until the week of November. Cases occurred in Dewsbury in *October*; and in *November* one case each from Ossett and Ravensthorpe, were added to these in Batley and Dewsbury. In *December*, Birstal, Heckmondwike and Liversedge were the districts infected in addition to Batley (where the disease had markedly recrudesced), and Dewsbury (where it had almost ceased). The early months of 1892, were characterised by a severe and wide extension of the small-pox. In *January* cases occurred in Birstal, Heckmondwike, Liversedge, Morley, Soothill Nether, and Soothill Upper, besides in Batley and Dewsbury, where it had now got a firm hold. In *February*, only three out of the fourteen districts of the Union were free from cases of small-pox, viz.:—Birkenshaw, Gomersal and Morley. Birkenshaw and Gomersal had no cases during the whole period under review, and the majority of those arising in Morley were of a remarkably mild type. In *March*, Liversedge and Ossett were free; but in *April*, a case occurred in the latter district. In *May*, there were no cases in Birstal, Liversedge, and Mirfield; in *June*, none in Birstal, Mirfield, and Thornhill. In *July*, the only districts which had cases were Batley, Dewsbury, Liversedge, Morley, and Thornhill; and in *August* (to the week ending 27th), cases had occurred in seven different districts, chiefly in Mirfield and Morley.

SKETCH MAP
OF THE
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF APRIL 1891.



To face page 24 (No. 7)

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SKETCH MAP
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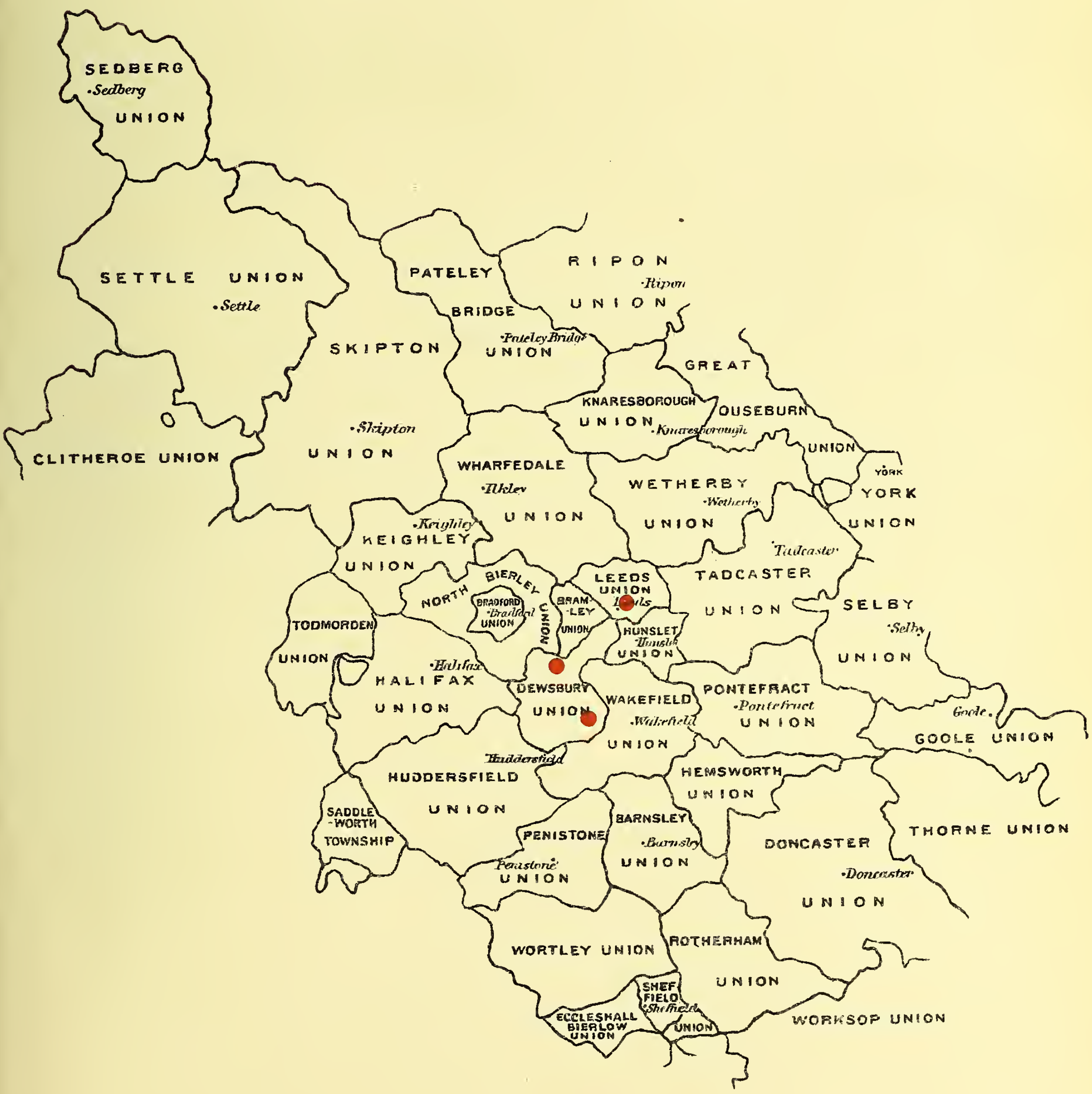
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF MAY 1891.



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SKETCH MAP
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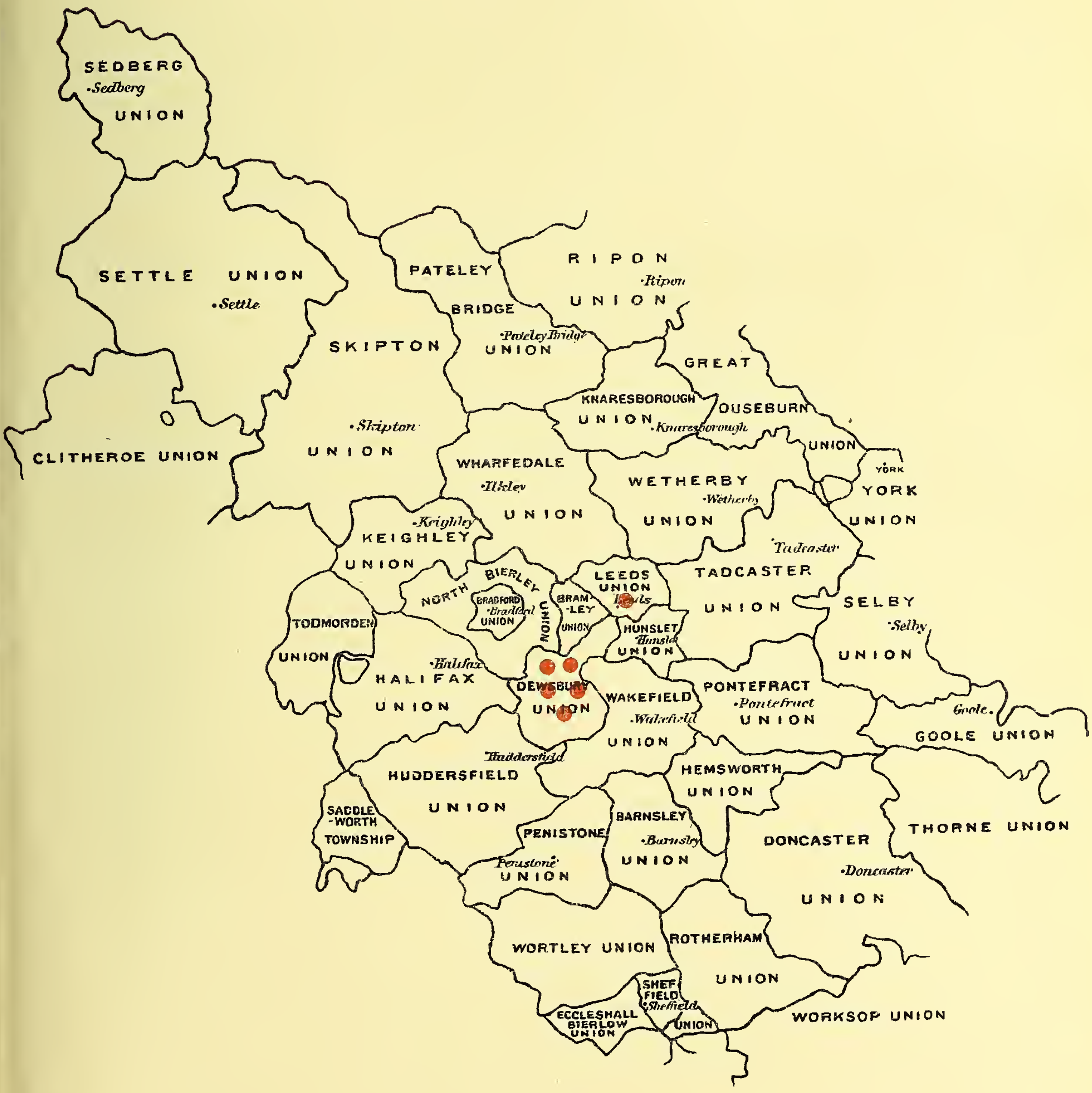
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF JUNE 1891.



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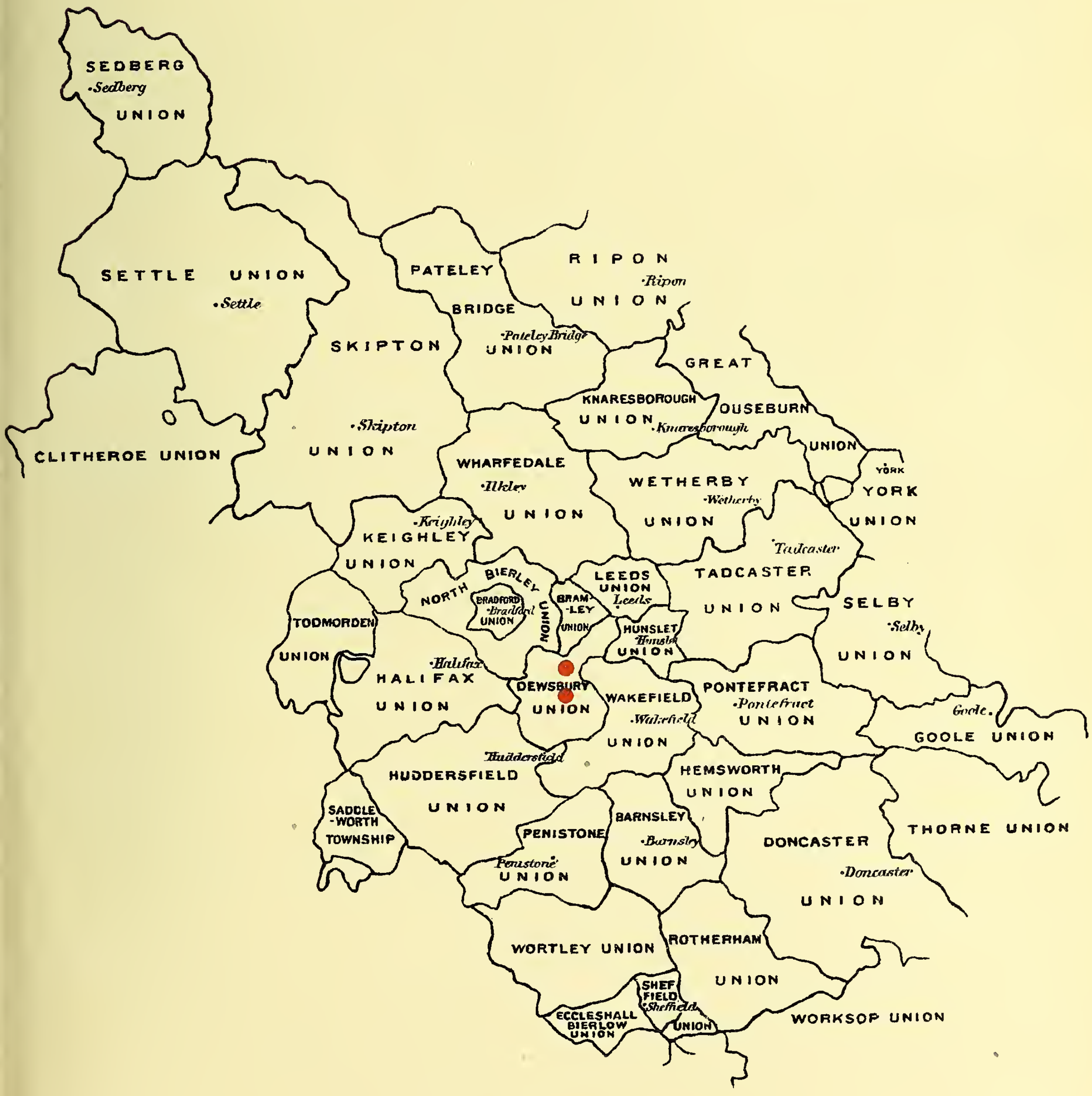
SKETCH MAP
OF THE
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF JULY 1891.



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SKETCH MAP
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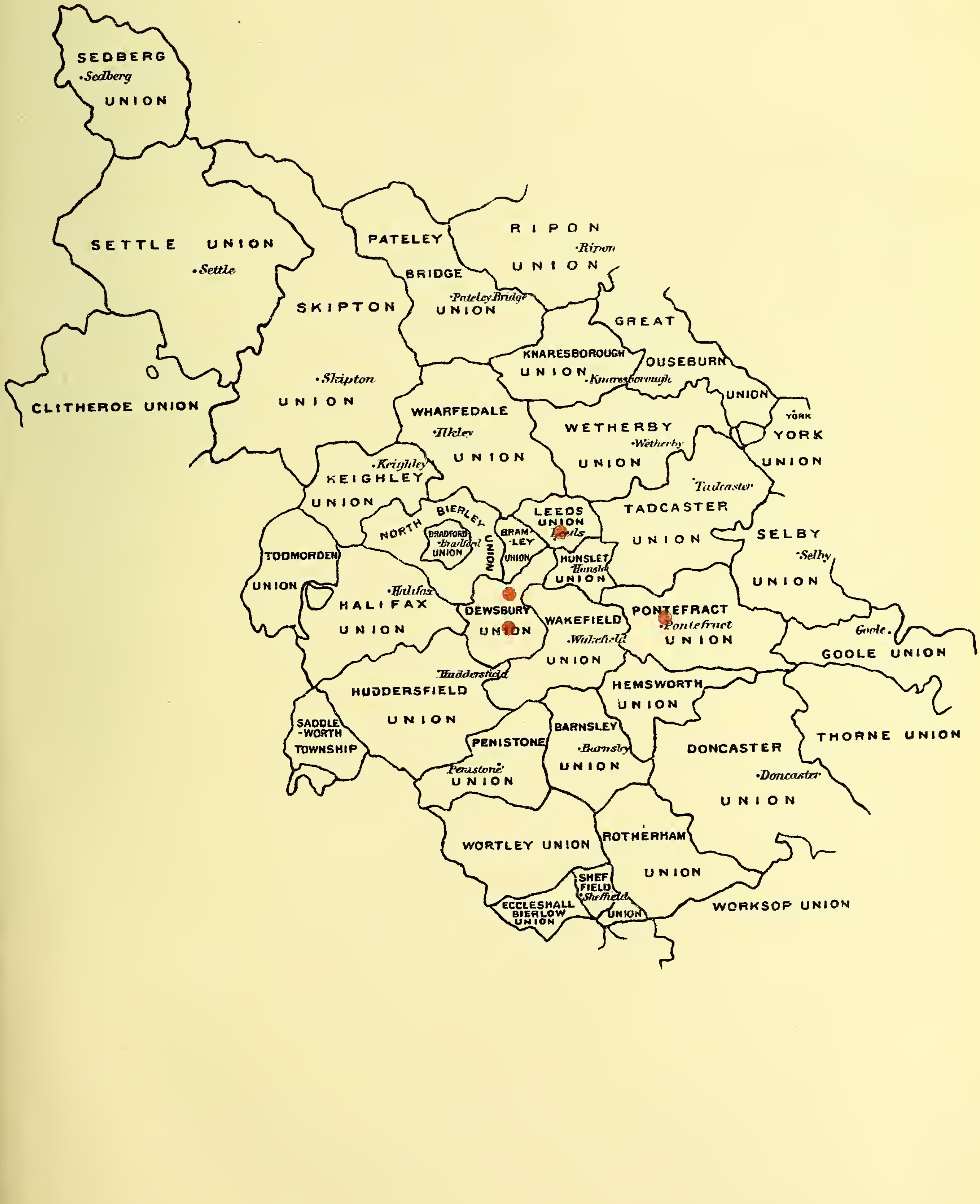
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF AUGUST 1891.



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SKETCH MAP
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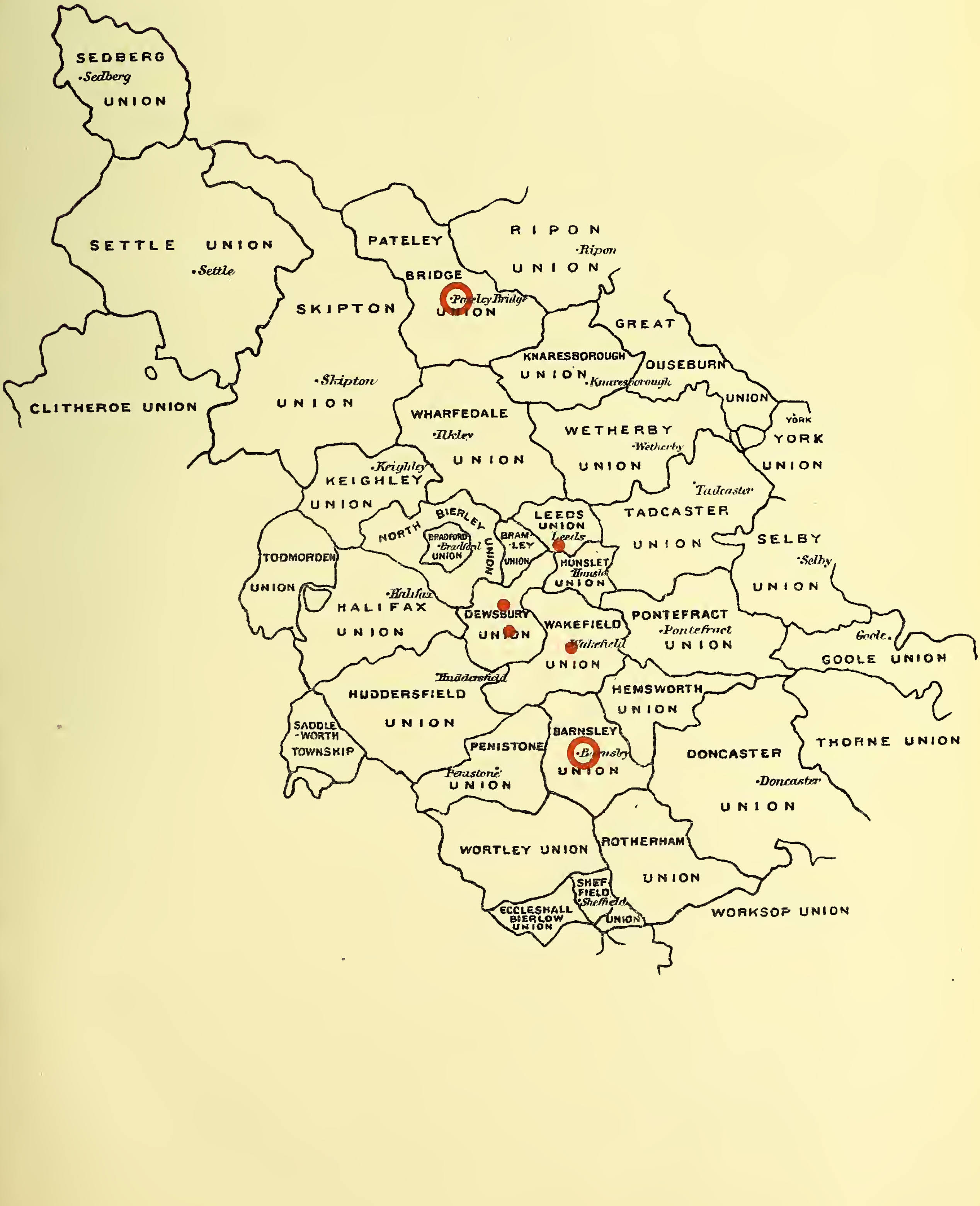
INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF SEPTEMBER 1891.



SKETCH MAP
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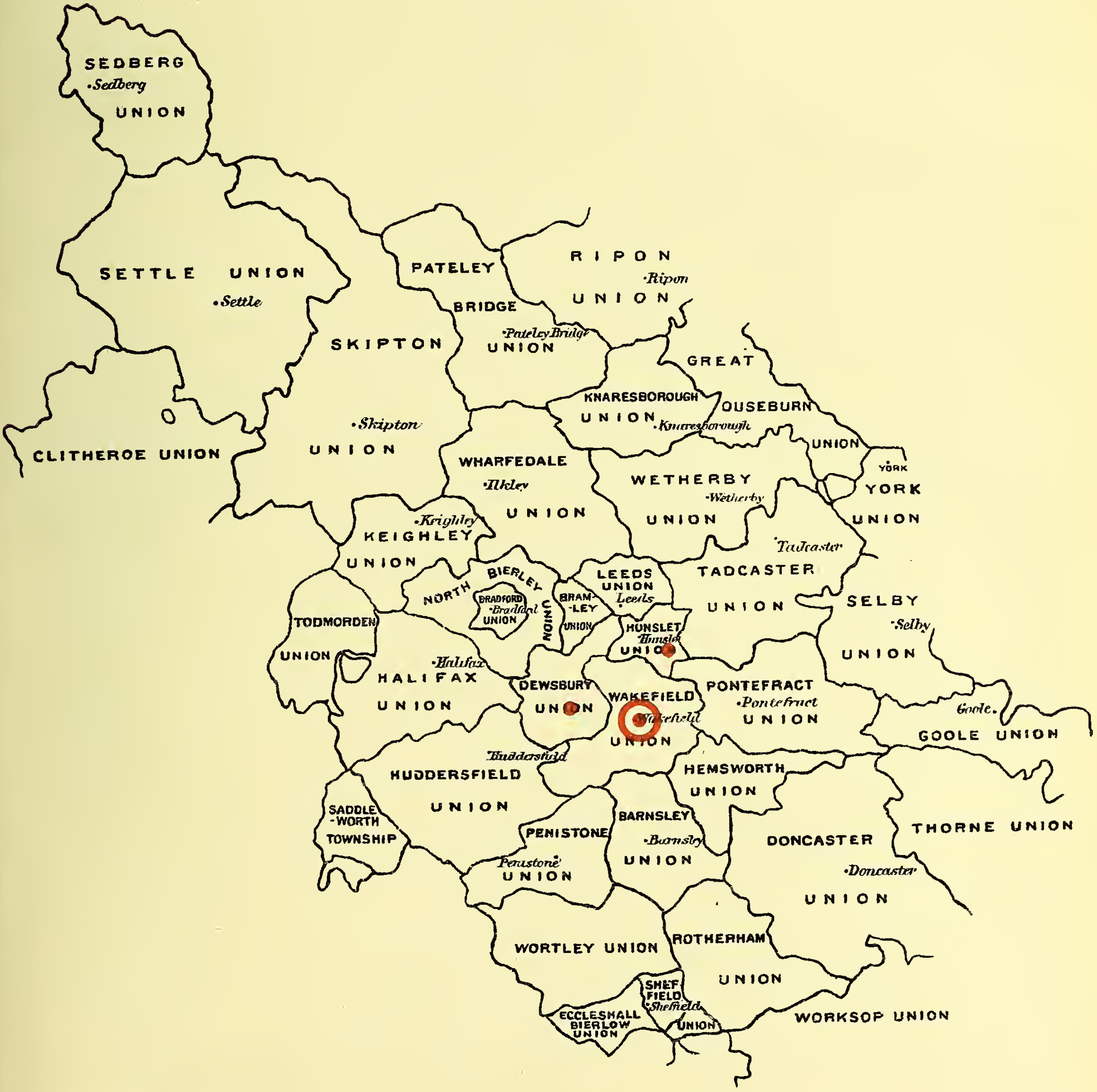
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF OCTOBER 1891.



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SKETCH MAP
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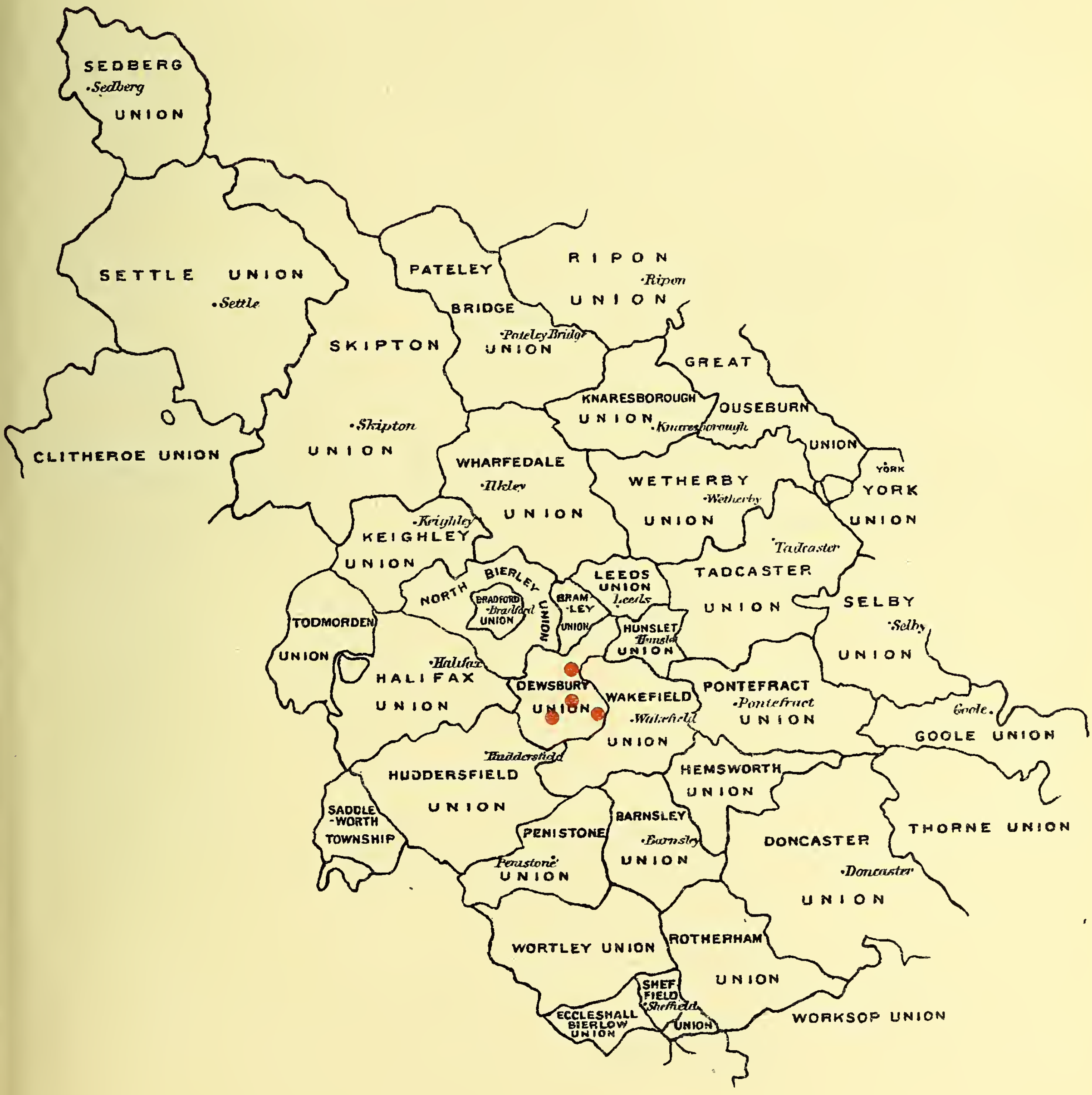
INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF NOVEMBER 1891.



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SKETCH MAP
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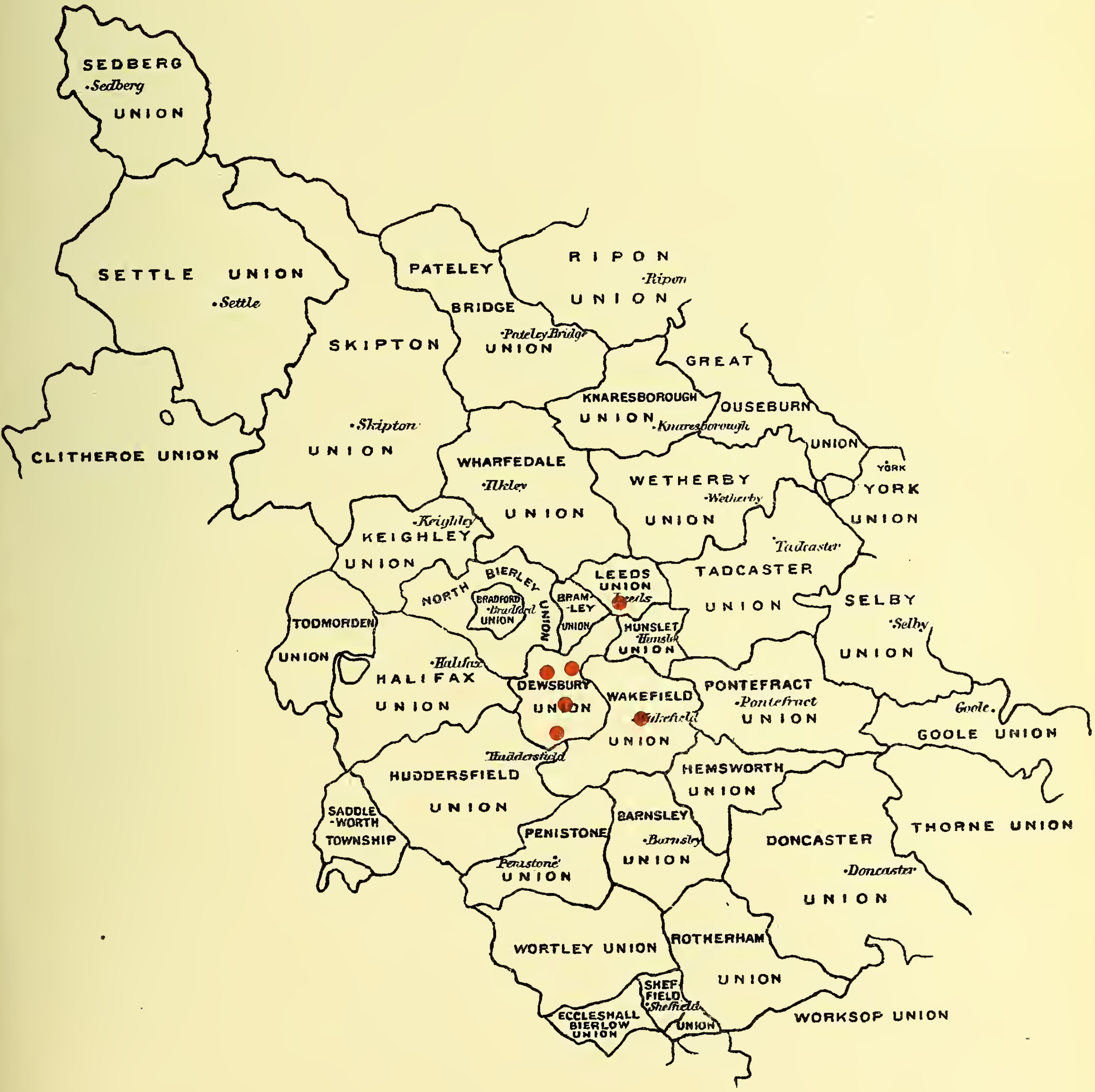
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF DECEMBER 1891.



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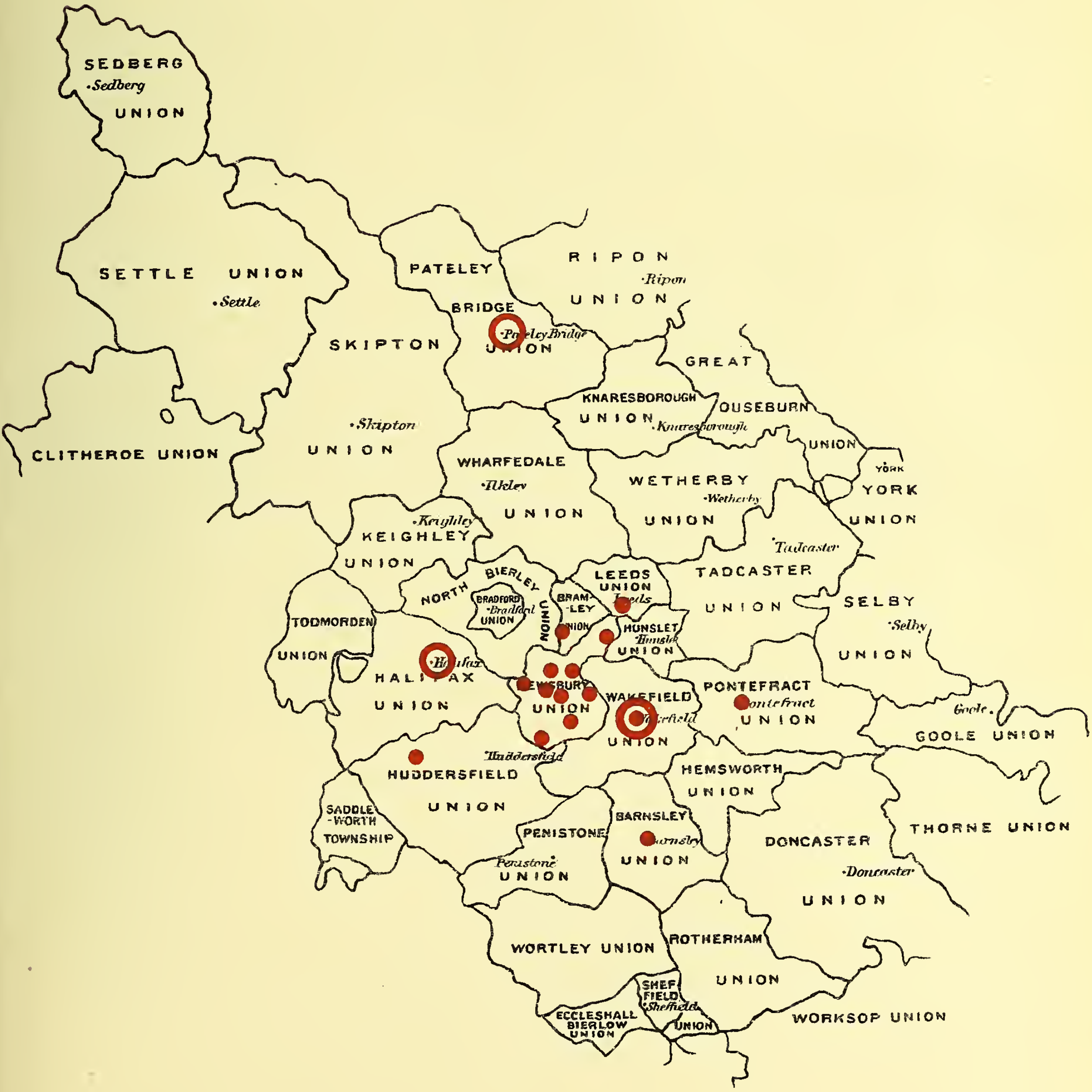
SKETCH MAP
OF THE
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF JANUARY 1892.



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SKETCH MAP
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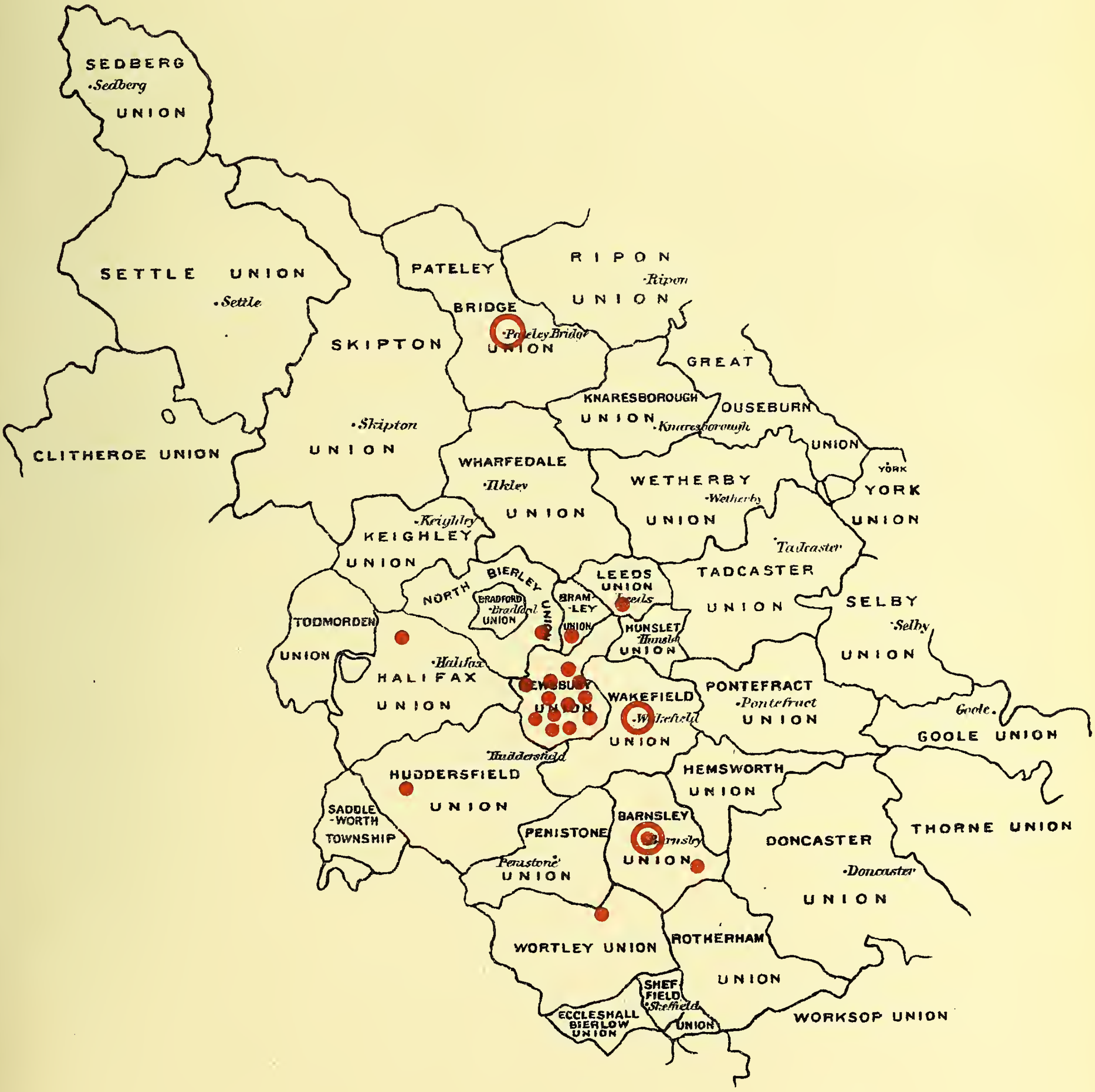
INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF FEBRUARY 1892.



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SKETCH MAP
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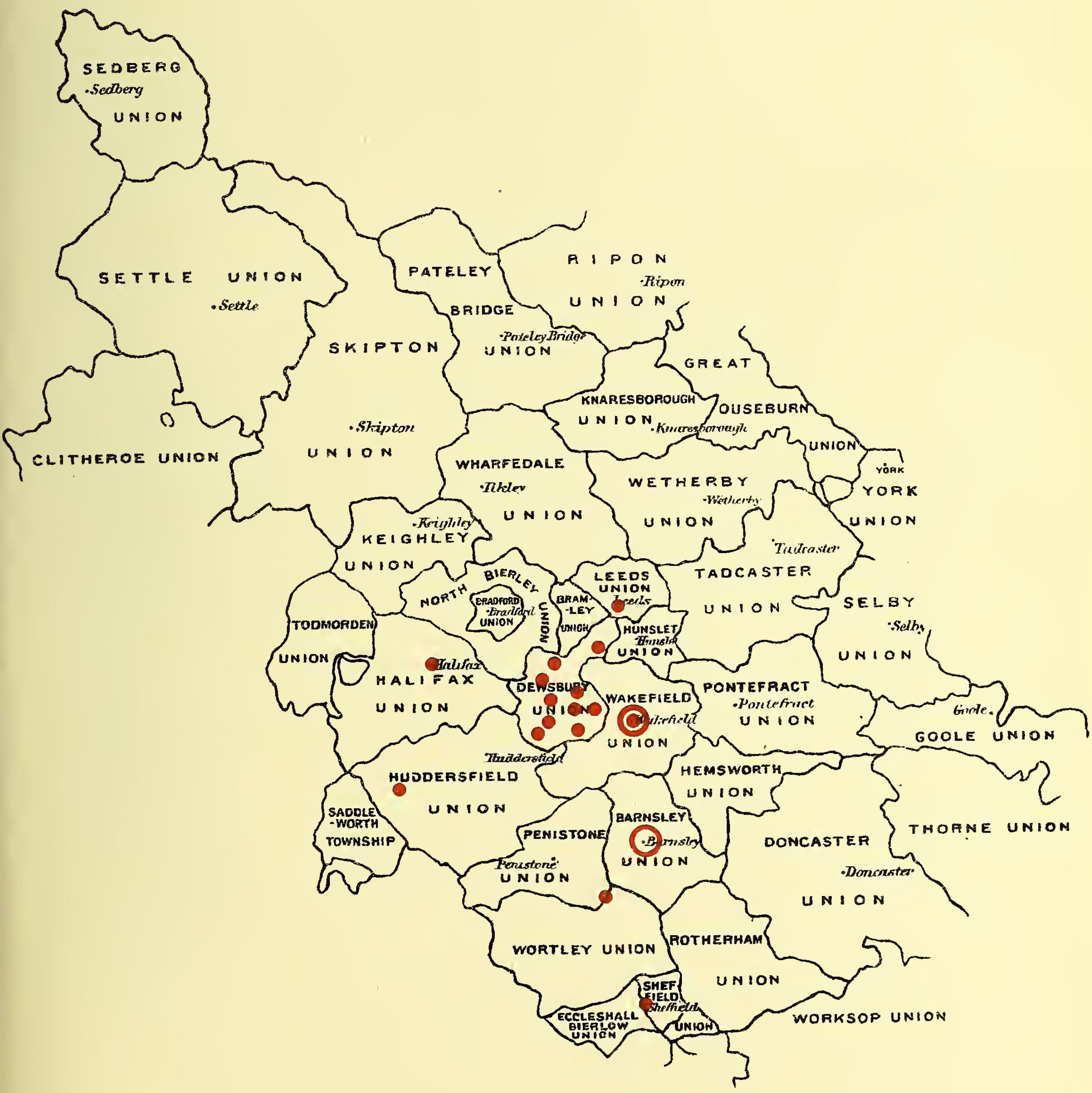
INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF MARCH 1892.



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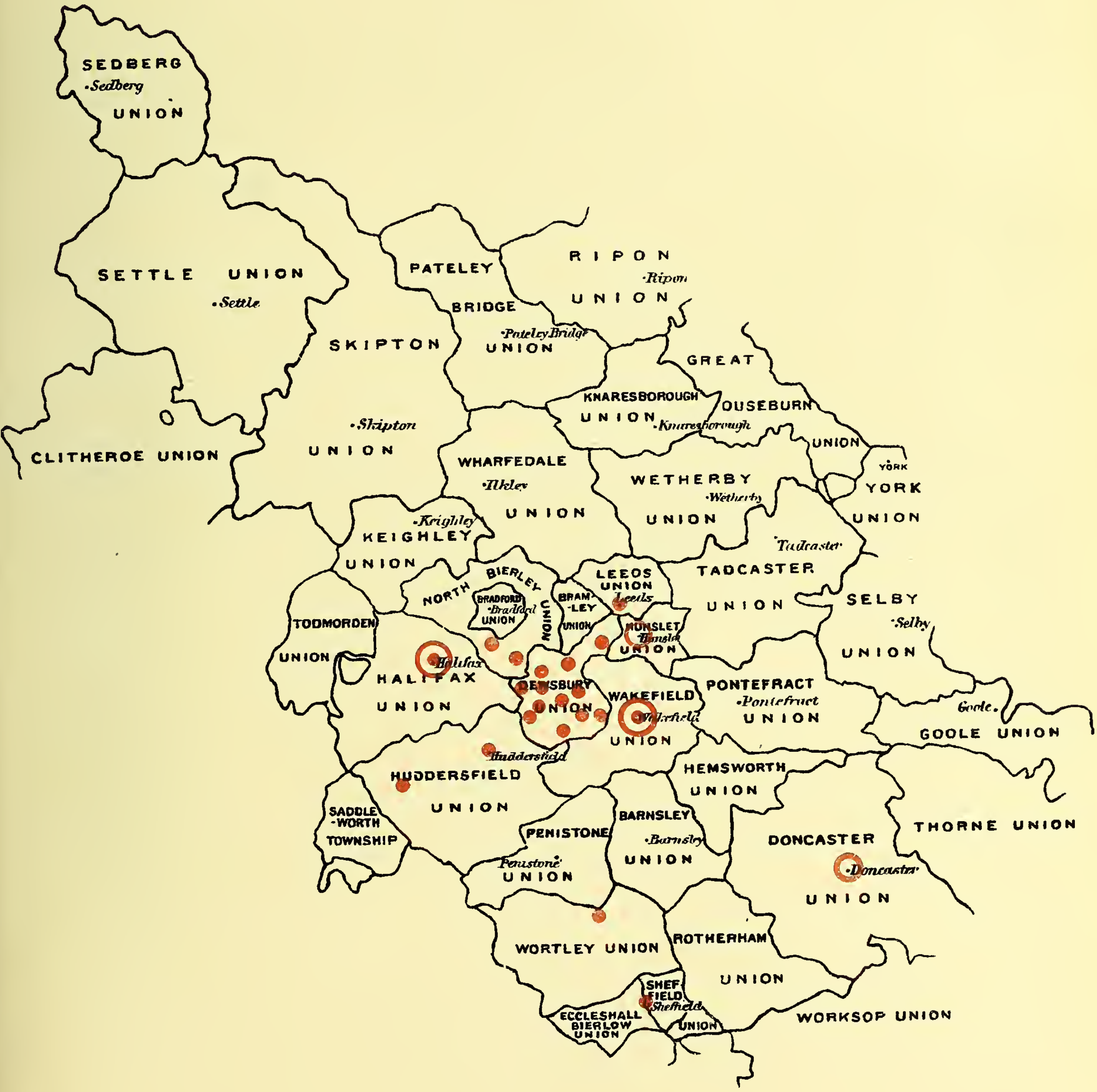
SKETCH MAP
OF THE
WEST RIDING OF YORKSHIRE,
INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF APRIL 1892.



face page 24 (No. 8.) 13

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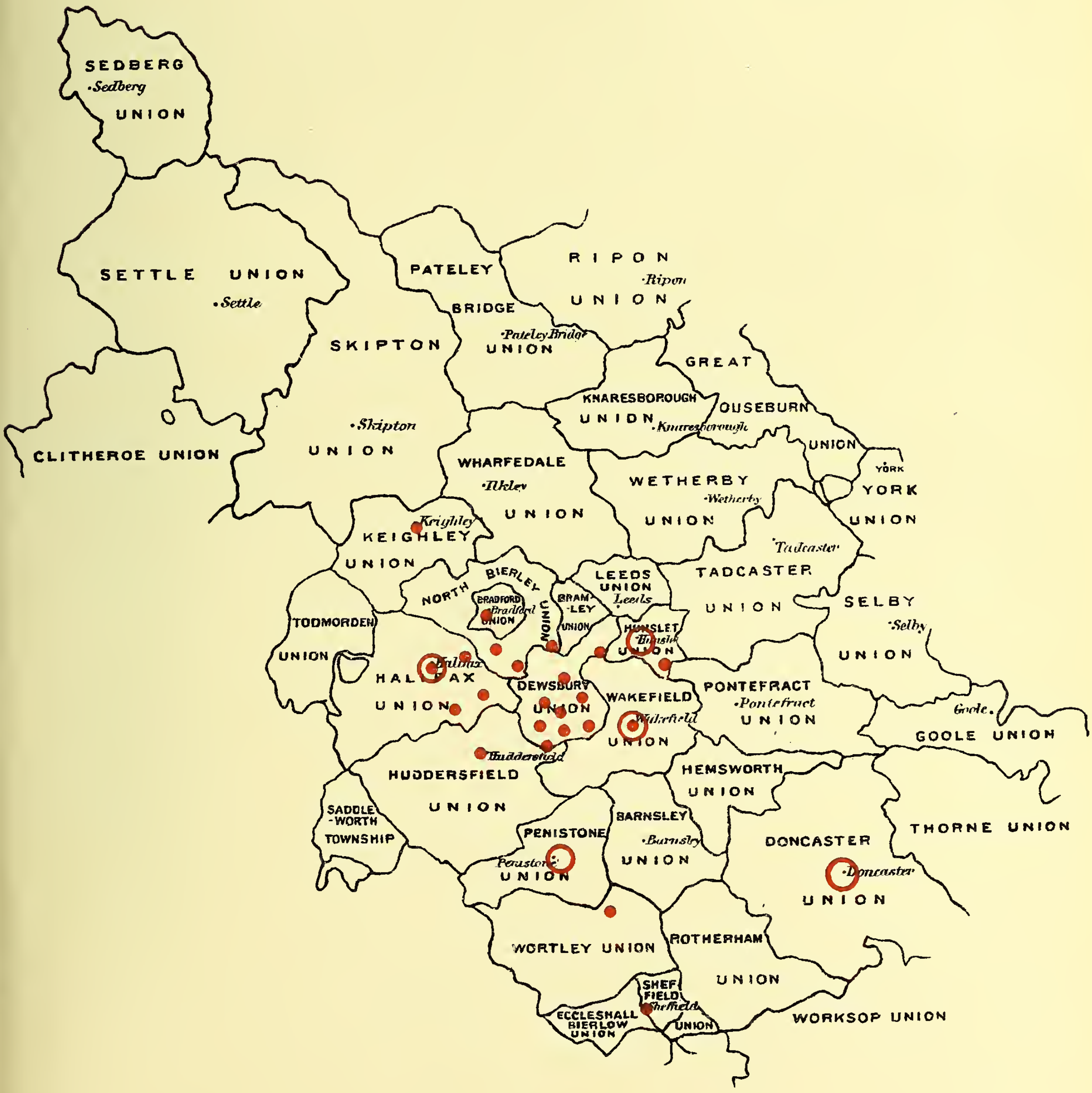
SKETCH MAP
OF THE
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF MAY 1892.



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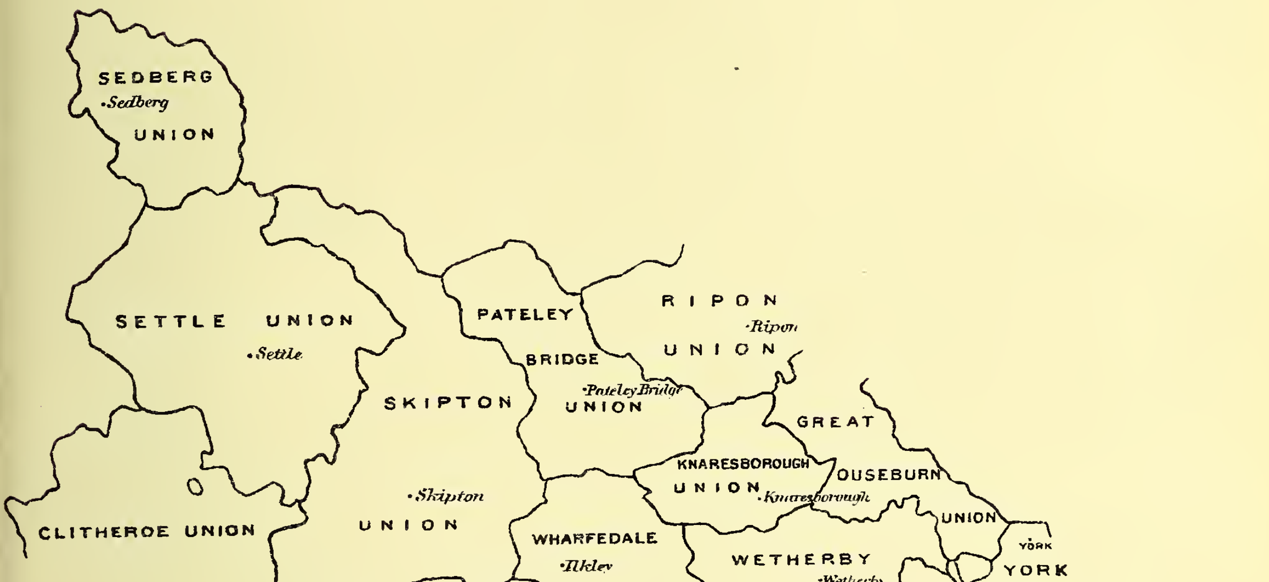
SKETCH MAP
OF THE
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF JUNE 1892.



ce page 24 (No 7.) 15.

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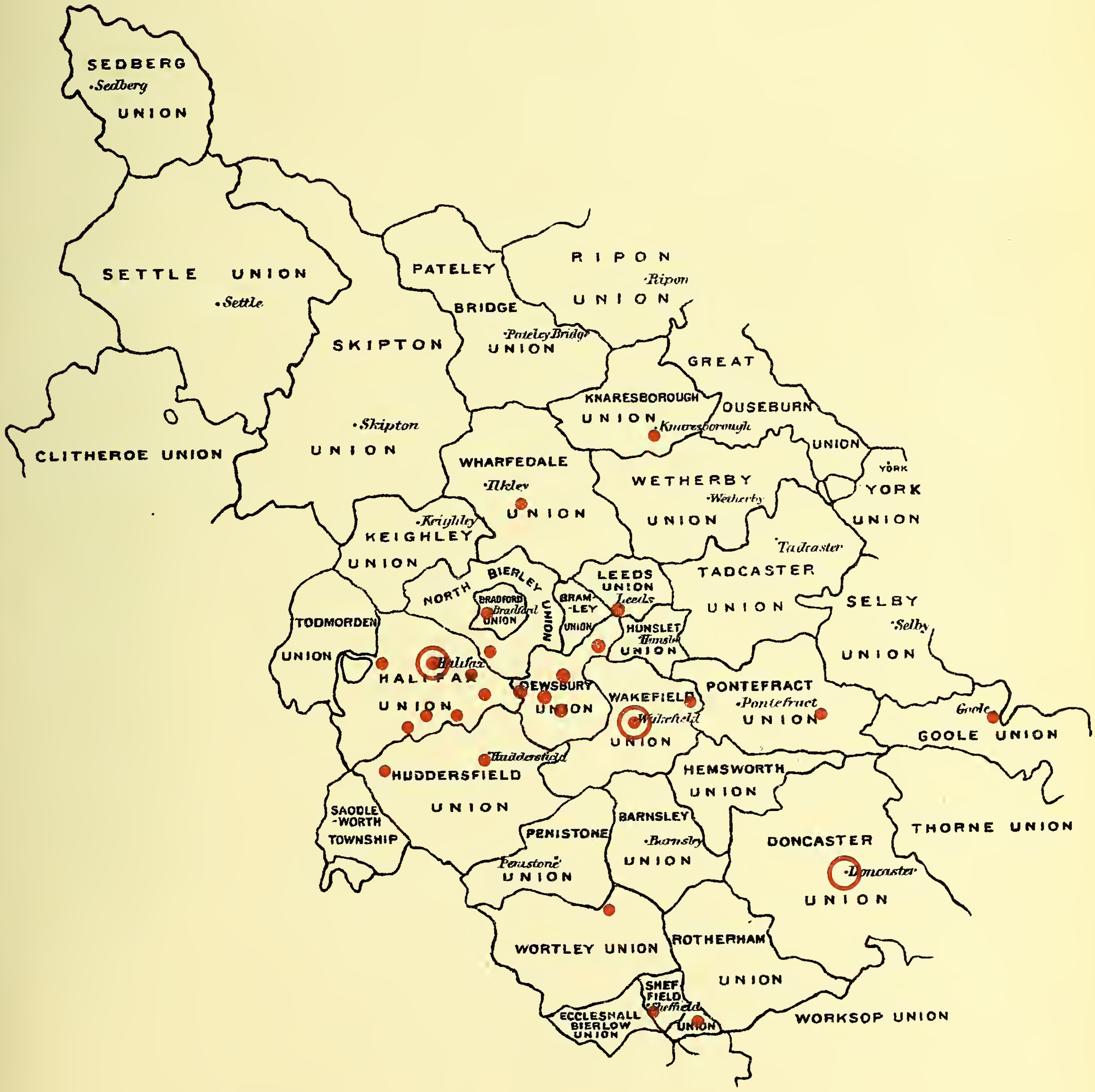
SKETCH MAP
OF THE
WEST RIDING OF YORKSHIRE,

INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF JULY 1892.



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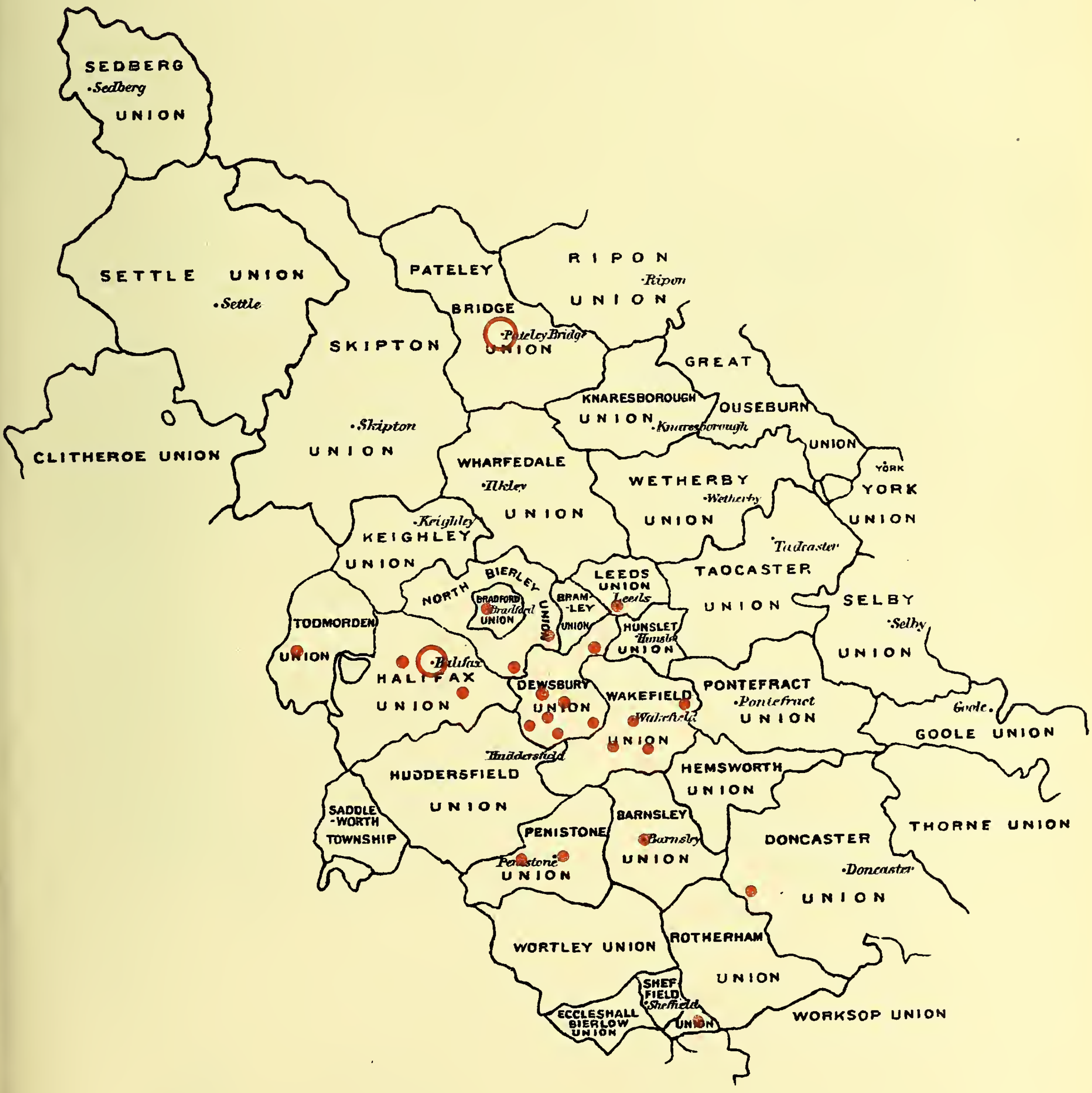
SKETCH MAP
OF THE
WEST RIDING OF YORKSHIRE,
INDICATING THE SANITARY DISTRICTS INVADED BY SMALLPOX IN THE MONTH OF AUGUST 1892.



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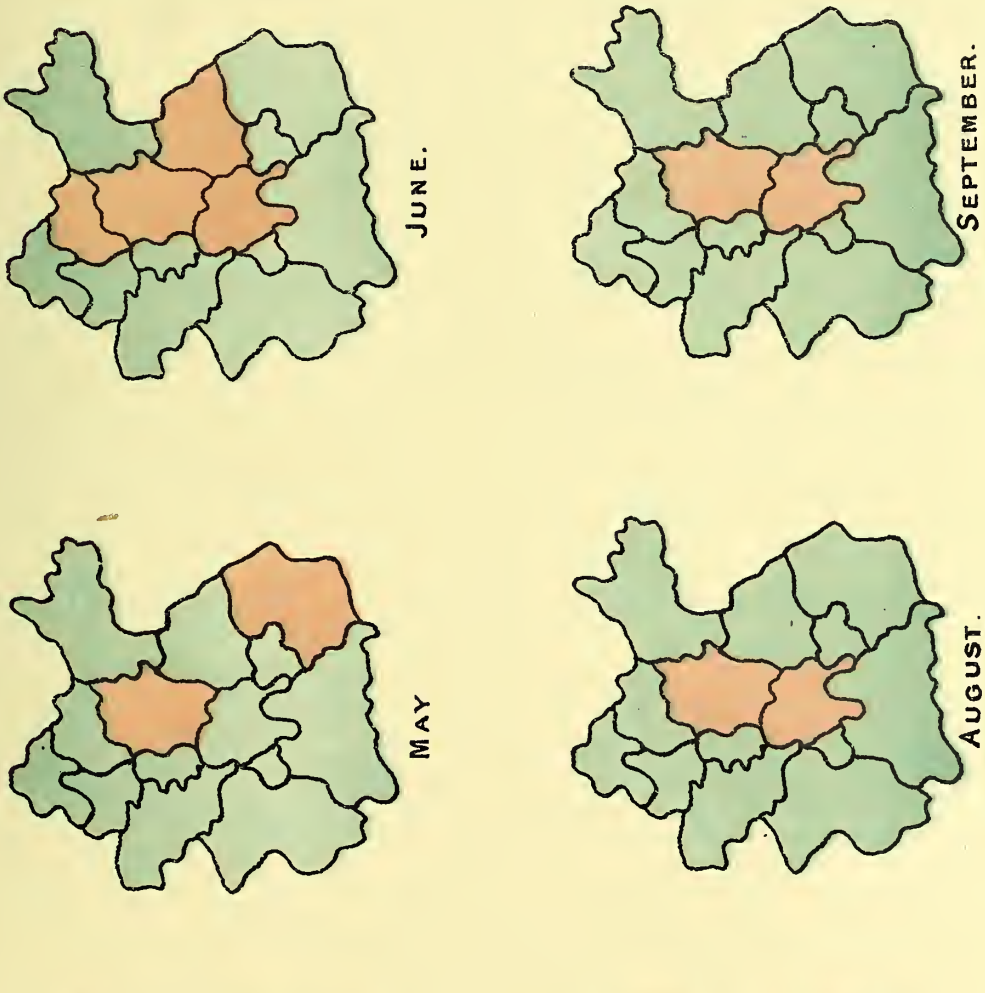
PLANS (A., B AND C.) INDICATING THE SANITARY DISTRICTS OF THE DEWSBURY UNION IN WHICH CASES OF SMALL-POX OCCURRED IN THE SEVERAL MONTHS APRIL 1891 TO AUGUST 1892.

PLAN A.

Explanation.

Red 🟥 *indicates infected Districts. Blue* 🟦 *indicates non-infected Districts.*
(N.B. For key-map see Plan C.)



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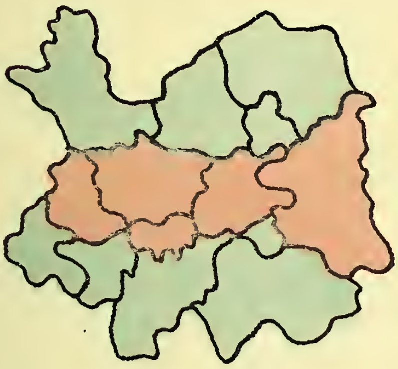
PLANS (A., B AND C.) INDICATING THE SANITARY DISTRICTS OF THE DEWSBURY UNION IN WHICH CASES OF SMALL-POX OCCURRED IN THE SEVERAL MONTHS APRIL 1891 TO AUGUST 1892.

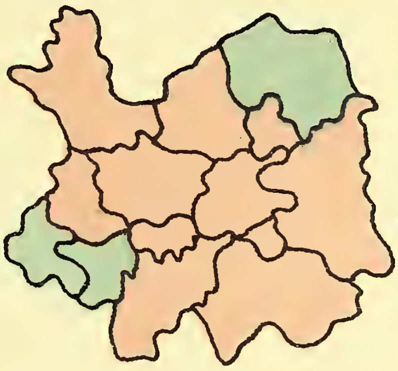
PLAN B.

Explanation.

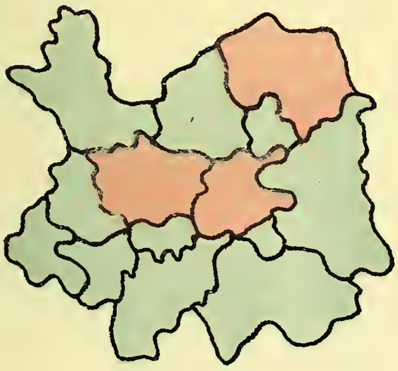
Red 🟥 *indicates infected Districts. Blue* 🟦 *indicates non-infected Districts.*
(N.B. For key-map see Plan C)



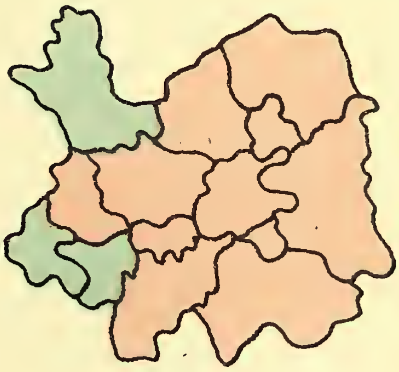
DECEMBER.



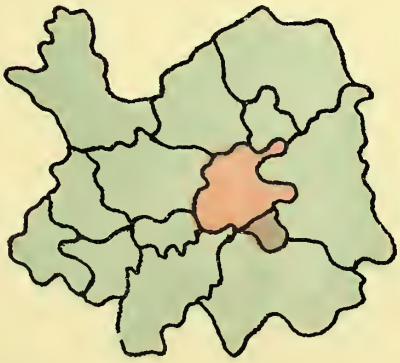
MARCH.



NOVEMBER.

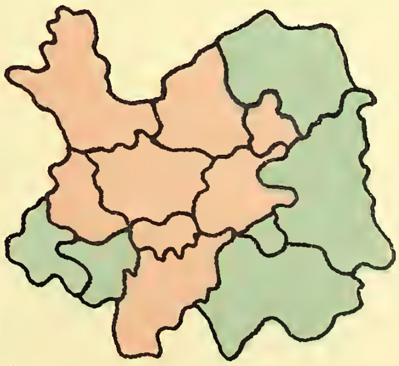


FEBRUARY.



OCTOBER.

1891



JANUARY.

1892

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PLANS (A., B AND C.) INDICATING THE SANITARY DISTRICTS OF THE DEWSBURY UNION IN WHICH CASES OF SMALL-POX OCCURRED IN THE SEVERAL MONTHS APRIL 1891 TO AUGUST 1892.

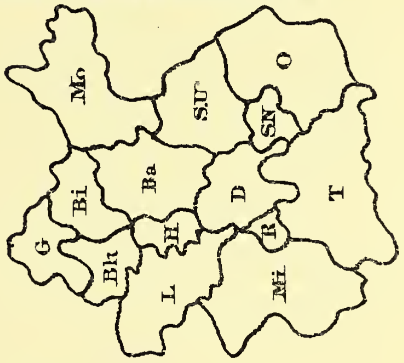
PLAN C.

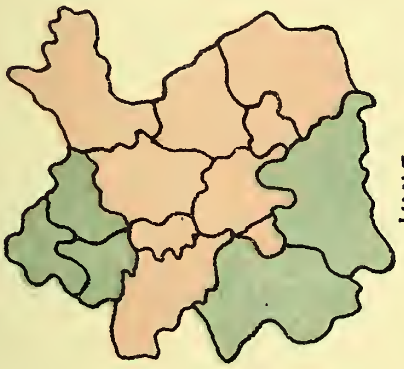
Explanation

Red 🟥 *indicates infected Districts. Blue* 🟩 *indicates non-infected Districts.*

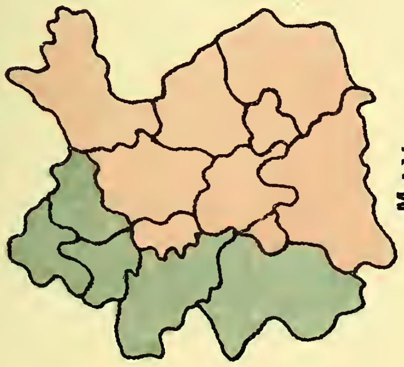
DEWSBURY UNION.

Ba.	*Batley.*
Bi.	*Birstal.*
Bk.	*Birkenshaw.*
D.	*Dewsbury.*
G.	*Gomersal.*
H.	*Heckmondwike.*
L.	*Liversedge.*
Mi.	*Mirfield.*
Mo.	*Morley.*
O.	*Ossett.*
R.	*Ravensthorpe.*
S.N.	*Soothill Nether.*
S.U.	——" —— *Upper.*
T.	*Thornhill.*

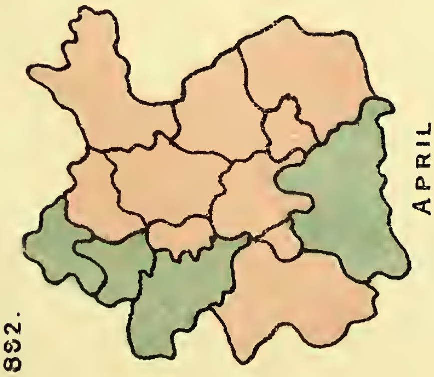




JUNE

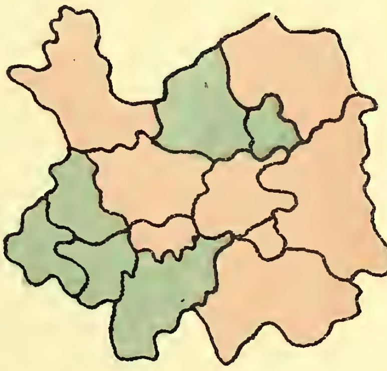


MAY

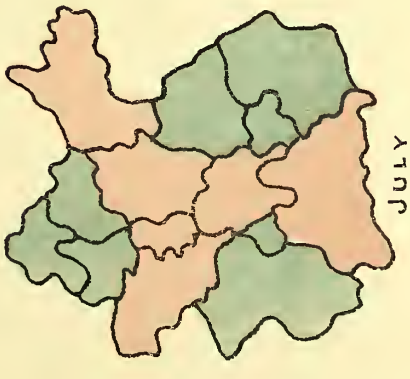


APRIL

1892.



AUGUST



JULY

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Chart I.

SMALL POX IN THE DEWSBURY UNION 1891-1892.

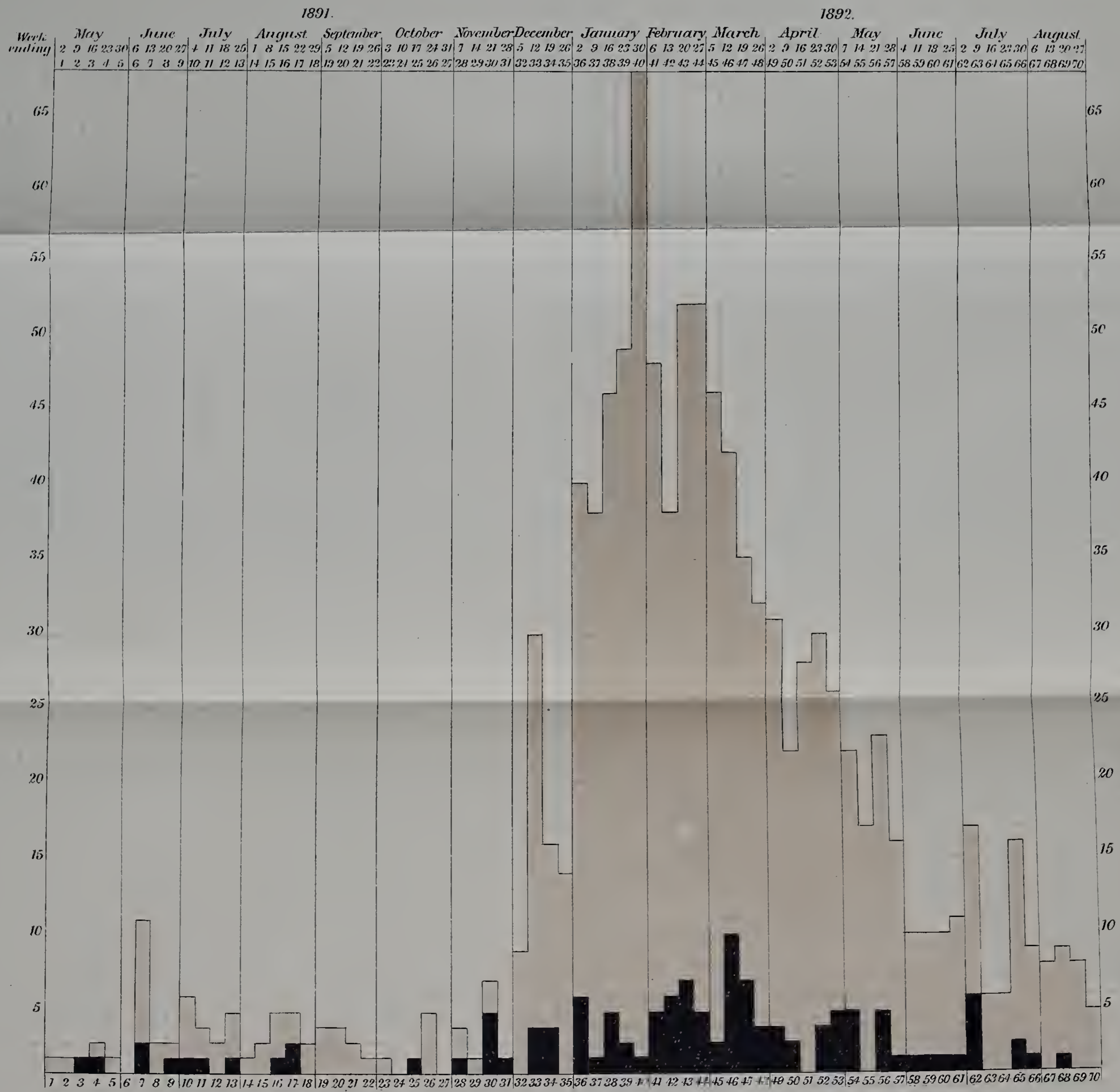

Chart shewing the Weekly Distribution of Cases in the whole Registration Districts for the 70 weeks from Week ending May 2nd 1891 to Week ending Aug. 27th 1892.

General sketch of outbreak.

Table XXIX.

Monthly Incidence of Small-Pox in the Dewsbury Union.

Urban Sanitary Districts.

—	Batley.	Dewsbury.	Birkenshaw.	Birstal.	Gomersal.	Heckmondwike.	Liversedge.	Mirfield.	Morley.	Ossett.	Ravensthorpe.	Soothill Nether.	Soothill Upper.	Thornhill.	Total Cases.	Deaths.
1891.																
April	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—
May	4	—	—	—	—	—	—	—	—	1	—	—	—	—	5	2
June	8	5	—	1	—	1	—	—	—	—	—	—	1	—	16	4
July	3	10	—	—	—	—	—	—	—	—	—	—	—	—	13	2
August	5	8	—	—	—	—	—	—	—	—	—	—	—	—	13	3
September	2	5	—	—	—	—	—	—	—	1	—	—	—	—	8	—
October	—	6	—	—	—	—	—	—	—	—	—	—	—	—	6	1
November	5	7	—	—	—	—	—	—	—	—	1	—	—	—	13	6
December	76	2	—	1	—	1	1	—	—	—	—	—	—	2	83	8
1892.																
January	176	23	—	2	—	7	3	—	2	—	—	2	4	—	219	11
February	123	44	—	1	—	4	4	1	—	8	1	2	4	6	198	20
March	83	37	—	3	—	13	—	1	1	—	2	1	9	6	156	21
April	35	44	—	2	—	5	—	5	8	1	2	5	4	1	112	10
May	16	31	—	—	—	4	—	—	6	6	8	2	3	2	78	9
June	1	17	—	—	—	2	11	—	7	2	1	2	1	—	44	8
July	5	19	—	—	—	1	1	—	11	—	—	—	—	1	38	4
August	2	7	—	—	—	1	—	5	6	1	2	—	—	2	26	1
	545	265	—	10	—	39	20	12	41	20	17	14	26	20	1,029	110

The weekly incidence of the disease is illustrated in Charts I. and II.; the former giving the total number of cases and the case-mortality for each of the 70 weeks; the latter represents diagrammatically the relative distribution of the cases in the three main divisions here adopted, viz., (1) Batley, (2) Dewsbury, and (3) "Other" Districts than (1) and (2), viz., those enumerated above. The figures on which these charts are based are given in the following table:—

Table XXX.

Small-Pox in the Dewsbury Union, 1891–92.

Charts I.* and II.

Week ending.	Batley.		Dewsbury.		Other Districts.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1891.								
May 2	1	—	—	—	—	—	1	—
„ 9	1	—	—	—	—	—	1	—
„ 16	1	1	—	—	—	—	1	1
„ 23	1	1	—	—	1	—	2	1
„ 30	1	—	—	—	—	—	1	—
June 6	—	—	—	—	—	—	—	—
„ 13	7	2	—	—	3	—	10	2
„ 20	—	—	2	—	—	—	2	—
„ 27	—	—	2	1	—	—	2	1
July 4	2	1	3	—	—	—	5	1
July 11	—	—	3	1	—	—	3	1
„ 18	—	—	2	—	—	—	2	—
„ 25	1	—	3	1	—	—	4	1
August 1	1	—	—	—	—	—	1	—
„ 8	1	—	1	—	—	—	2	—
„ 15	2	—	2	1	—	—	4	1
„ 22	2	—	2	2	—	—	4	2
„ 29	—	—	2	—	—	—	2	—
September 5	—	—	3	—	—	—	3	—
„ 12	1	—	1	—	1	—	3	—
„ 19	1	—	1	—	—	—	2	—
„ 26	—	—	1	—	—	—	1	—
October 3	—	—	1	—	—	—	1	—
„ 10	—	—	—	—	—	—	—	—
„ 17	—	—	1	1	—	—	1	1
„ 24	—	—	4	—	—	—	4	—
„ 31	—	—	—	—	—	—	—	—
November 7	—	—	2	1	1	—	3	1
„ 14	—	—	1	—	—	—	1	—
„ 21	4	3	2	1	—	—	6	4
„ 28	1	1	—	—	—	—	1	1
December 5	6	—	2	—	—	—	8	—
„ 12	27	3	—	—	2	—	29	3
„ 19	15	3	—	—	—	—	15	3
„ 26	11	—	2	—	—	—	13	—

* *Explanation of Chart I.:—*
This Chart shows the total number of cases arising in all the infected districts of the Dewsbury Union in each of the 70 weeks covered by the inquiry, viz., from the week ending May 2nd, 1891, to the week ending August 27th, 1892. It also indicates the number of fatal attacks amongst the cases so arising. The total number of cases was 1,029; of deaths, 110.

General sketch of outbreak.

SMALL-POX IN THE DEWSBURY UNION, 1891–92—*continued.*

Week ending.	Batley.		Dewsbury.		Other Districts.		Totals.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1892.								
January 2	34	3	2	2	3	—	39	5
„ 9	29	1	6	—	2	—	37	1
„ 16	34	4	2	—	9	—	45	4
„ 23	41	2	5	—	2	—	48	2
„ 30	53	1	8	—	6	—	67	1
February 6	31	3	7	1	9	—	47	4
„ 13	22	2	10	2	5	1	37	5
„ 20	35	5	12	1	4	—	51	6
„ 27	26	1	13	1	12	2	51	4
March 5	30	2	9	—	6	—	45	2
„ 12	23	5	9	1	9	3	41	9
„ 19	15	2	10	1	9	3	34	6
„ 26	17	2	5	—	9	1	31	3
April 2	14	1	7	1	9	1	30	3
„ 9	6	1	7	1	8	—	21	2
„ 16	7	—	13	—	7	—	27	—
„ 23	11	2	9	1	9	—	29	3
„ 30	6	—	14	3	5	1	25	4
May 7	5	1	7	2	9	1	21	4
„ 14	4	—	4	—	8	—	16	—
„ 21	6	2	10	2	6	—	22	4
„ 28	—	—	10	1	5	—	15	1
June 4	1	—	3	1	5	—	9	1
„ 11	—	—	3	1	6	—	9	1
„ 18	1	—	2	1	6	—	9	1
„ 25	—	—	2	1	8	—	10	1
July 2	1	1	9	3	6	1	16	5
„ 9	—	—	3	—	2	—	5	—
„ 16	1	—	2	—	2	—	5	—
„ 23	1	1	8	1	6	—	15	2
„ 30	2	—	4	1	2	—	8	1
August 6	2	—	1	—	4	—	7	—
„ 13	—	—	3	1	5	—	8	1
„ 20	—	—	1	—	6	—	7	—
„ 27	—	—	2	—	2	—	4	—
	545	57	265	39	219	14	1,029	110

Outbreak in the Union workhouse.

Leaving the record of particular features of the epidemic to the account furnished of its spread in each of the infected districts it may be useful to point out in this place that the occurrence of a small outbreak amongst the inmates of the Dewsbury Union Workhouse coincided with the appearance of the disease in Dewsbury. There can be little question that small-pox was introduced into the Workhouse by the transference to the building set apart for infectious diseases at the Workhouse Infirmary of cases from Batley, which at that time had no special provision for their isolation. Nine of the 23 cases occurring at Batley—April to September 1891—were thus removed to the Workhouse Infirmary, viz., one in April, two in May, five in June, and one in July. The six inmates of the infirmary who contracted the disease were attacked in June, July, and August; but immediately prior to this the first case notified in Dewsbury itself was that of a young weaver employed at a mill adjoining the workhouse at Staincliffe. It is of course impossible to say whether he, and indeed others living in the vicinity who also suffered early in the outbreak, were infected from their proximity to the Infirmary. There were other conditions for the spread of the disease—once it had gained entrance into a working population like that of Batley and Dewsbury. That it was primarily introduced through infected rags is of course highly probable; but the incidence of the disease fell far more upon the class of weavers and miners than on those more directly concerned in the rag trade (*i.e.*, rag-sorters, rag-pickers, &c.). The lack of hospital accommodation at Batley during the months of December to March may have contributed to the diffusion of the disease, but a chief share in this diffusion must unquestionably be ascribed to the mines, workshops, and elementary schools. It will be seen from the foregoing Tables and Chart II.* that the disease was vastly more prevalent during the months of January, February, and March that at any other period of like extent, more than half the cases of the 16 months occurring then—or in Batley about 70 per cent. of the whole number, in Dewsbury about 40 per cent., and in the other districts about 40 per cent. As showing the different degrees of prevalence in a more striking manner one may divide the 16 months—May to August—into four periods which would give for

Batley.

—	Cases.	Deaths.
1st period (May–August 1891.)	20 or 3·6 per cent.	5 or 8·7 per cent.
2nd period (September–December 1891.)	83 „ 15·2 „	12 „ 21·0 „
3rd period (January–April 1892.)	417 „ 76·6 „	35 „ 61·4 „
4th period (May–August 1892.)	24 „ 4·4 „	5 „ 8·7 „
	544	57

Dewsbury.

1st period	23 or 8·7 per cent.	6 or 15·4 per cent.
2nd „	20 „ 7·5 „	3 „ 7·7 „
3rd „	148 „ 55·8 „	15 „ 38·4 „
4th „	74 „ 28· „	15 „ 38·4 „
	265	39

Other Districts.

1st period	4 or 1·8 per cent.	0
2nd „	7 „ 3·2 „	0
3rd „	120 „ 54·8 „	12 or 85·7 per cent.
4th „	88 „ 40·2 „	2 „ 14·3 „
	219	14

It will be seen that the case prevalence did not correspond with the "mortality" except during one of the periods. The figures are too few to permit of any deduction being made as to varying severity of the cases in regard to the period of the outbreak, nor would this be at all profitable since the inquiry has not covered the whole of the epidemic.†

Of the total number, 1,029 cases, all but eight occurred in private dwellings. As already stated six were inmates of the Workhouse Infirmary (which are reckoned in the Dewsbury series as cases arising in the Workhouse are notified to the Dewsbury Sanitary Authority), one was a nurse at the Dewsbury Infirmary, and one a nurse engaged at the Batley Small-Pox Hospital.

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* *Explanation of Chart II.:—*
In this Chart the relative distribution (weekly) of the cases of small-pox arising in the Union among the several districts is represented. The different shades of tint indicate the number of cases occurring in—
(*a.*) *Batley, 545 cases,*
(*b.*) *Dewsbury, 259 cases,*
(*c.*) *Other districts of union, 219 cases,*
(*d.*) *Union workhouse, 6 cases,*
} *=1,029.*

† *See note (*) at foot of next page.*

Chart II.

SMALL POX IN THE DEWSBURY UNION 1891-1892.

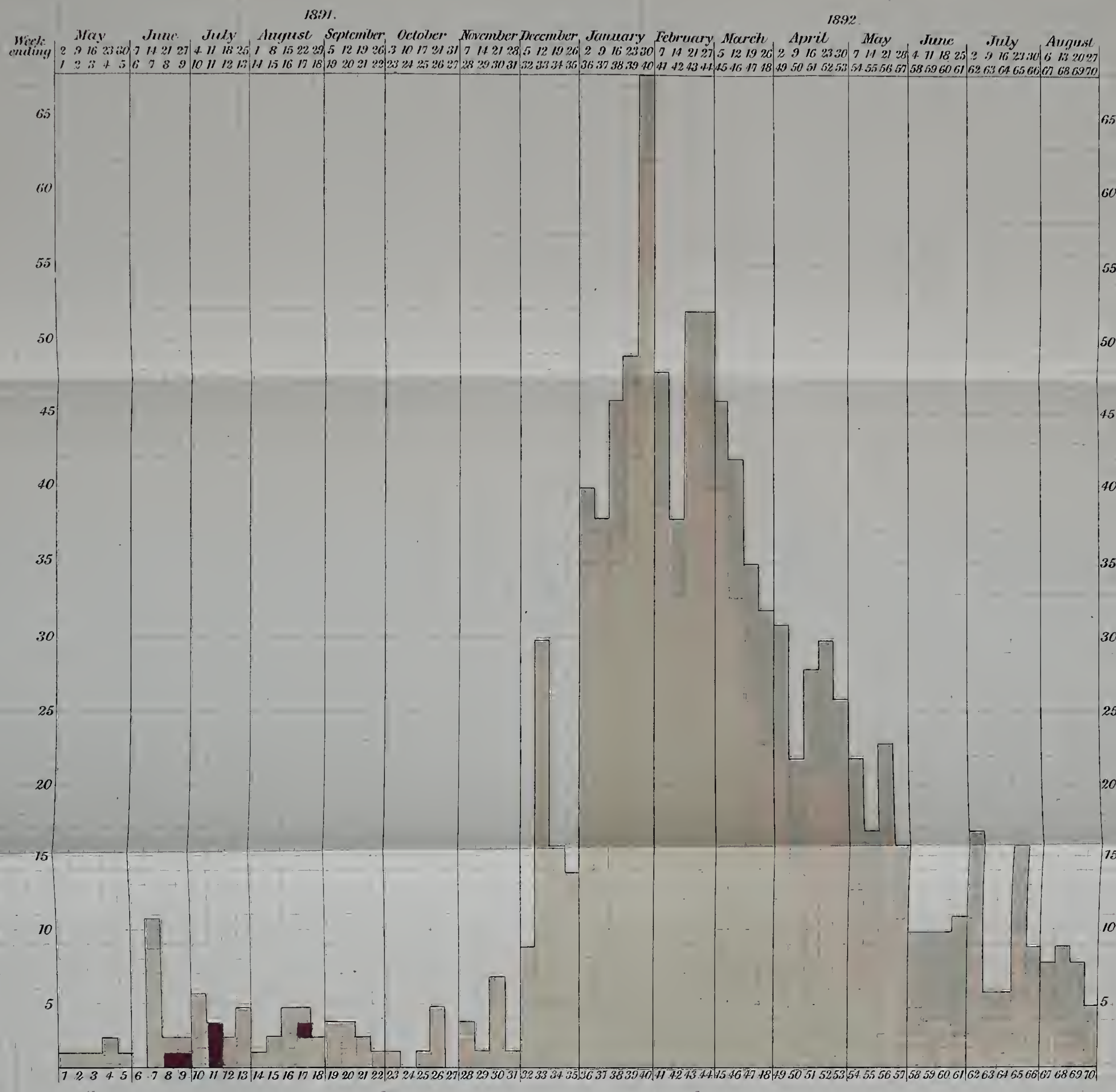

Chart shewing Weekly Distribution of Cases, arising in the Several Districts.

Batley .... ▭
Dewsbury .... ▭
Other Districts .... ▭
Union Workhouse .... ■

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Lit. Lith. 63 Carter Lane. 0306.4.97

The 1,021 cases came from 645 houses, namely one case from 426 households, and the remainder—595—consisted of two or more members of 219 households. More precisely stated—

In 426 houses there occurred 426 cases.
,, 125 ,, ,, ,, 250 ,,
,, 55 ,, ,, ,, 165 ,,
,, 25 ,, ,, ,, 100 ,,
,, 8 ,, ,, ,, 40 ,,
,, 3 ,, ,, ,, 18 ,,
,, 2 ,, ,, ,, 14 ,,
,, 1 ,, ,, ,, 8 ,,

The months in which these houses were severally invaded, and the number of cases arising therefrom were as follows :—

TABLE XXXI.

1891.			1892.		
Month.	No. of Houses Invaded.	No. of Cases in Houses.	Month.	No. of Houses Invaded.	No. of Cases in Houses.
April - - -	1	1	January - -	132	236
May - - -	4	5	February - -	121	177
June - - -	12	15	March - - -	100	139
July - - -	9	13	April - - -	78	116
August - -	5	9	May - - -	44	64
September - -	5	8	June - - -	23	49
October - -	4	6	July - - -	19	28
November - -	11	22	August - -	21	23
December - -	56	110			

Particulars were obtained by personal inquiry of the inmates of 544 houses,‡ viz.: 130 in Deswbury, 267 in Batley, and 147 in the "Other" Districts. The inmates of these houses amounted to exactly 3,000, the number of cases of small-pox which had occurred amongst them being 887. So that the proportion of houses to inmates was 1 : 5·5; of houses to cases 1 : 1·6; and of cases to inmates 1 : 3·3. In this community of 3,000 individuals rather les than one-third had the disease.

General sketch of outbreak.

Proportion of inmates to cases of small-pox in houses,

Of the 544 houses there was one case of small-pox in 355 whilst two or more cases occurred in the remaining 189 houses, which yielded 232 cases, thus distributed :—

Houses.	Cases.
355	355
98	196
52	156
25	100
8	40
3	18
2	14
1	8
544	887

The number of inmates to a house varied from one—a female living by herself, who contracted small-pox—to 11, so that there were—

Houses.	Number of Inmates per House.	Total Persons.
11	11	121
19	10	190
27	9	243
43	8	344
60	7	420
91	6	546
95	5	475
102	4	408
62	3	186
33	2	66
1	1	1
544	Yielding a total of 3,000 persons.	

It may be of further interest to ascertain the relative number of cases of small-pox occurring in the larger and smaller households, and a table may be drawn up to assist in this analysis, thus :—

---

‡ Visits were made to many more of the invaded houses, but from various causes, such as absence of all inmates at work, or their removal from the neighbourhood, &c. the inquiry came to be restricted as above.

* The following table is prepared from the Monthly Reports of the County Council Medical Officer, and gives the cases of small-pox notified in each of the districts, subsequent to August 1892 :—

—	Batley.	Dewsbury.	Birkenshaw.	Birstal.	Gomersal.	Heckmondwike.	Liversedge.	Mirfield.	Morley	Orsett.	Ravenscroft.	Soothill Nether.	Soothill Upper.	Thornhill.	—
1892.															
September - -	—	4	—	—	—	—	—	—	—	—	—	—	—	1	5
October - -	—	6	—	—	—	2	1	—	—	—	—	—	—	1	10
November - -	1	4	—	—	—	4	2	—	1	—	—	4	—	2	18
December - -	5	13	—	—	—	†	†	—	1	1	—	1	—	—	21
1893.															
January - -	5	10	—	—	—	1	—	5	1	4	—	—	1	2	29
February - -	—	7	—	2	—	—	4	2	1	—	—	2	—	—	18
March - -	1	3	—	—	—	—	—	—	—	—	1	2	3	—	10
April - -	2	5	—	—	—	—	—	1	5	8	—	—	—	—	21
May - -	1	6	—	—	—	—	—	—	—	2	8	—	—	1	18
June - -	—	—	—	—	—	1	—	—	—	3	—	†	—	—	4
July - -	—	5	—	—	2	6	—	—	—	2	—	—	—	—	15
	15	63	—	2	2	14	7	8	9	20	9	9	4	7	169

† No return.

General sketch of outbreak.

Table XXXII.

Number of Inmates per House.	Number of Houses.	Number of Cases of Small-pox per House.								Total Inmates.	Total Cases.
		1.	2.	3.	4.	5.	6.	7.	8.		
11	11	8	1	1	—	1	—	—	—	121	18
10	19	8	2	3	2	1	2	—	1	190	54
9	27	14	6	2	4	—	—	1	—	243	55
8	43	20	7	9	5	1	—	1	—	344	93
7	60	30	14	12	2	1	1	—	—	420	113
6	91	55	18	9	6	3	—	—	—	546	157
5	95	70	10	8	6	1	—	—	—	475	143
4	102	72	22	8	—	—	—	—	—	408	140
3	62	53	9	—	—	—	—	—	—	186	71
2	33	24	9	—	—	—	—	—	—	66	42
	1	1	—	—	—	—	—	—	—	1	1
	544	355	98	52	25	8	3	2	1	3,000	887

Single and multiple cases in households.

As might be surmised the larger households mostly present a larger proportion of "multiple" cases than do the smaller, but there is no regular scale of increase in proportion as the numbers presumably exposed to infection rise. Nor is this to be wondered at, since so many factors may have contributed to "protect" the remaining inmates from the contagion. The point, however, will be referred to again in a subsequent part of this report. Meanwhile the relative proportions of single and of multiple cases in these households may be stated in approximate terms, as:—

Households, Members of.	Single Cases.	Multiple.
	Per cent.	Per cent.
11	72	28
10	42	58
9	52	48
8	46	54
7	50	50
6	60	40
5	74	26
4	70	30
3	85	15
2	73	27

Sex and age of those attacked.

Of the total number of cases of small-pox, 1,029, 521 were males, and 508 females. These may be classified in age-groups as follows:—

—	Male.	Female.	Both Sexes.
Under 1 year of age - -	14	15	29
From 1 to 10 years - - -	88	106	194
„ 10 to 30 years - -	278	283	561
„ 30 years and upwards -	137	101	238
Age not ascertained - -	4	3	7
	521	508	1,029

Comparison of sex and age of those attacked and not attacked.

Analysing in the same manner the community of 3,000 persons of whom 887 contracted small-pox, we obtain the relative age-incidence of the disease to the total numbers exposed at the various ages:—

—	Total Number of Inmates of House.	Total of Cases of Small-pox.	Per-centage attacked.
Under 1 year - - -	75	25	33·3
1 to 10 years - - -	651	177	27·2
10 to 30 „ - - -	1,351	483	34·2
30 and upwards - - -	902	202	22·3
Age not ascertained - -	21	—	—
	3,000	887	29·2

Reference may here be made to Chart III.* where facts as to age incidence are diagrammatically represented. The Chart also gives the number of fatal attacks. It will be seen that of 203 attacked in age-period, 0 to 10 years, 48, or 23·6 per cent. died; of 482 attacked between 10 and 30 years, 24 died, or 4·9 per cent.; and of 202 aged 30 and upwards 11 died, or 5·4 per cent.

Of the whole number (3,000) exposed to infection, 126 had previously suffered from small-pox, 6 of them being again attacked. Of these individuals, 102 were aged 30 years and upwards, 23 between 10 and 30 years, and of one the age was not ascertained.

With but few exceptions the incidence of the disease fell upon members of the working class community, and as the proportion of those engaged in weaving and allied industries, is naturally greatest in this district, it was amongst this class, that a larger number of cases were to be found than in any other avocation.

In order to facilitate comparison I have separated all persons concerned into three main groups, viz:—

(*a.*) Those living at home, having either no fixed occupation, or engaged in domestic duties, or in work carried on in their dwellings.

This class comprises therefore most of the children under 5 years of age, and the great majority of mothers of families.

(*b.*) The children attending school, their ages ranging between 4 and 15 years.

(*c.*) Those engaged in work at factories, mines and elsewhere, and only going home for meals and rest.

Under the first head, those "*At Home,*" are included 340 cases of small-pox, viz., 99 males and 241 females.

Under the second head, those "*At School,*" are included 173 cases of small-pox, viz., 90 males and 83 females.

Under the third head those "*At Work,*" are included 510 cases of small-pox, viz., 329 males and 181 females.

The total number, 1,029, is made up by the addition of the 6 inmates of the workhouse infirmary who contracted the disease.

Reserving to the sections dealing with particular districts any detailed list of the occupations of those attacked with small-pox, it may be useful here to give in tabular form a condensed summary of these returns:—

Table XXXIII.

—	Males.					
	Under 1 year.	1 to 10 years.	10 to 30 years.	30 and over.	Age not ascertained.	Total.
At home:—						
Of no occupation - -	14	34	6	2	1	57
Engaged in trade, &c. - -	—	—	14	28	—	42
At school - - - - -	—	54	36	—	—	90
At work:—						
Mill or factory - - - -	—	—	67	26	1	94
Rag sorter - - - -	—	—	1	3	—	4
Miner - - - - -	—	—	81	17	—	98
Other occupations - -	—	—	55	53	—	108
Occupation not ascertained -	—	—	15	8	2	25
Workhouse inmates - -	—	—	3	—	—	3
Total - - -	14	88	278	137	4	521

---

* *Explanation of Chart III.:—*

In this Chart the incidence of small-pox upon the members of 544 houses visited during the inquiry is represented. The total number of this community was 3,000, and in the Diagram each small square represents one individual. These are arranged in four groups according to age periods; those attacked with small-pox being indicated by shading.

—	*Persons.*	*Attacked.*	*Died.*
Group A. (under 10 years) -	*726*	*202*	*48*
„ *B. (10 to 30 years)* -	*1,351*	*483*	*24*
„ *C. (30 years upwards)* -	*902*	*202*	*11*
„ *D. (age not known)* -	*21*	*None.*	

The diagram further shows the numbers of those who had previously suffered from small-pox. Of these there are 24 in Group B., including 2 again attacked in this epidemic; 101 in Group C., of whom 3 were again attacked, and 1 in Group D.

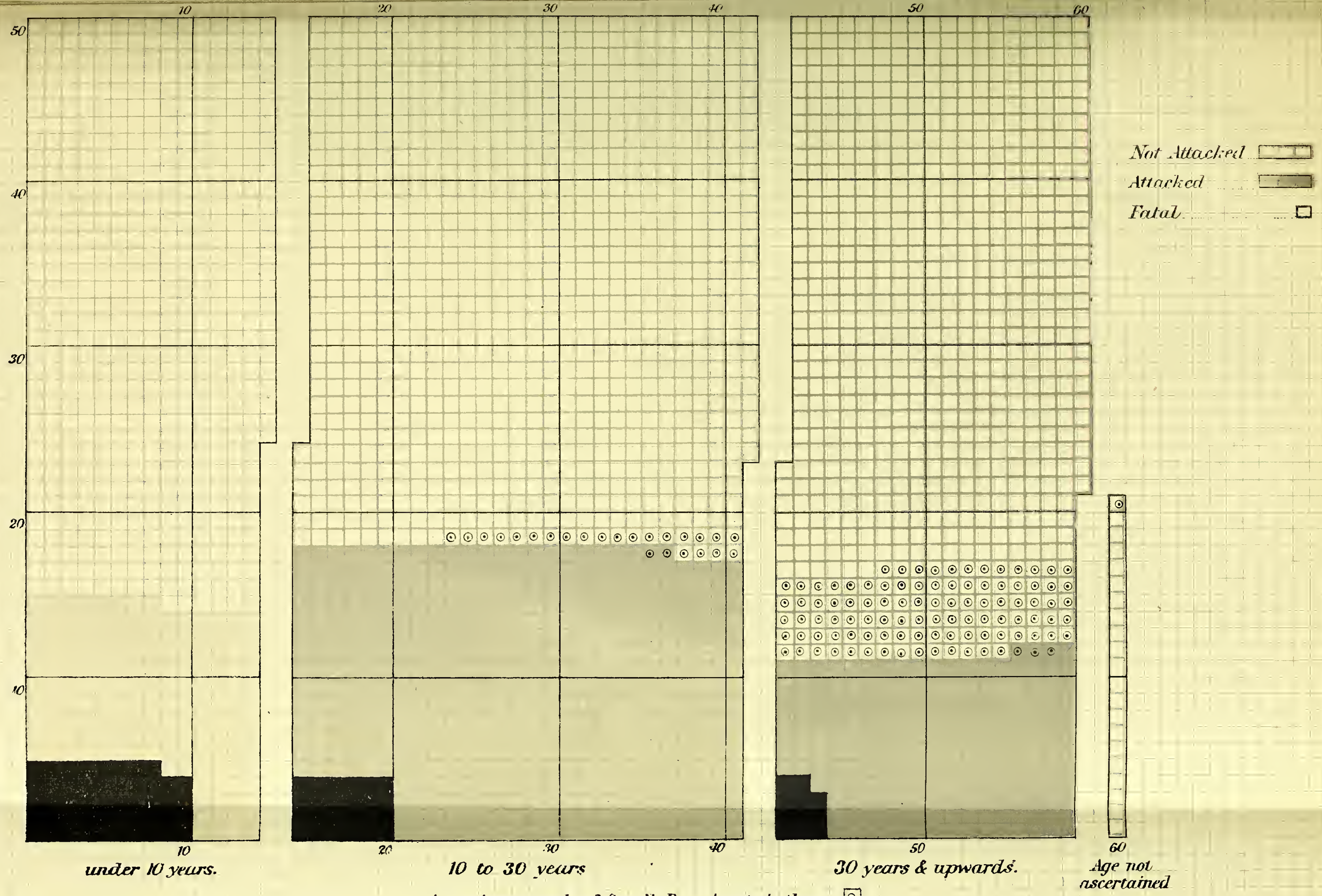

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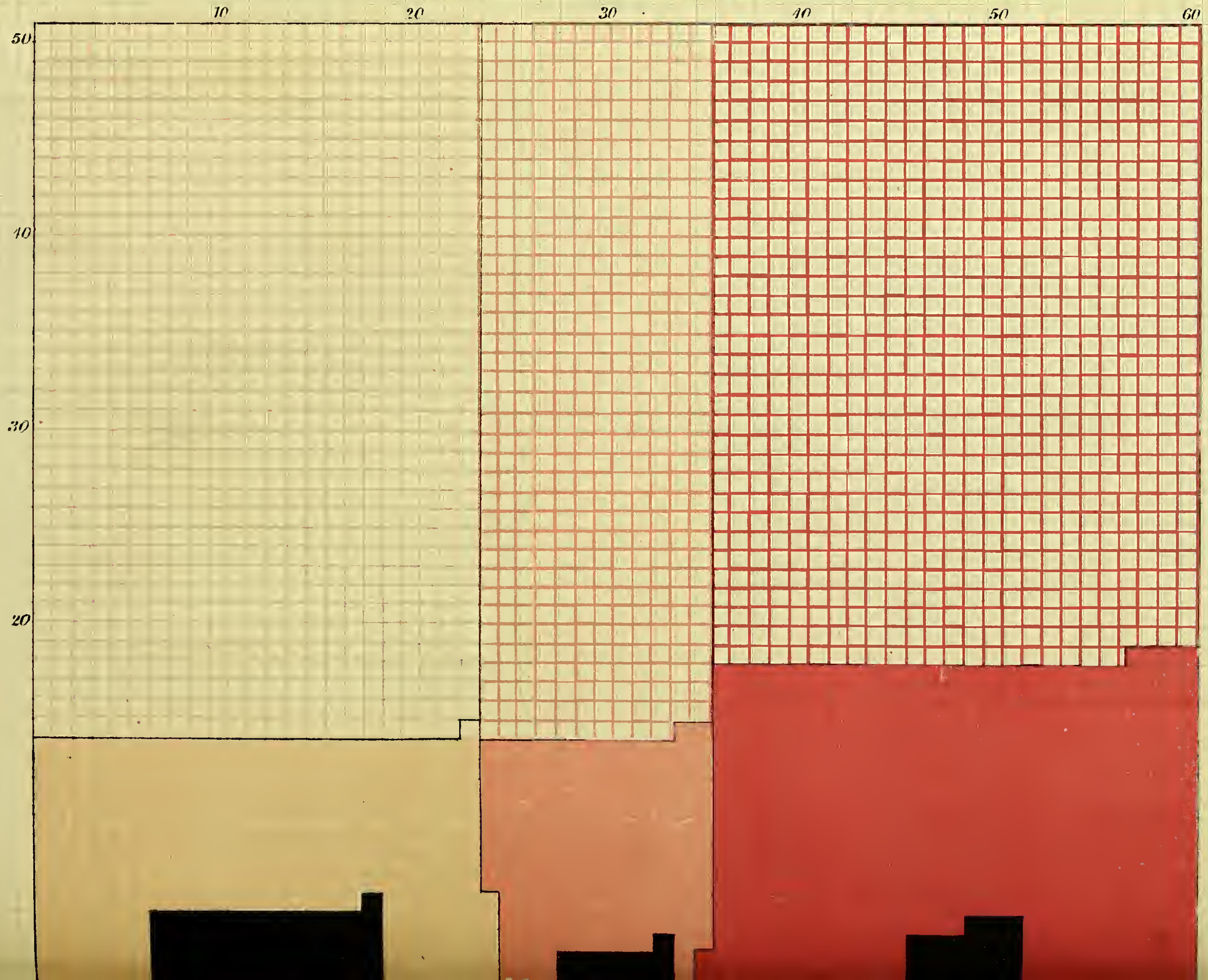
Chart. IV.

CHART SHEWING PROPORTION OF THOSE ATTACKED WITH SMALL POX OUT OF 3000 INMATES IN HOUSES, (ALL DISTRICTS OF THE DEWSBURY UNION.)



The different shades of colour represent the 3 groups into which the 3000 inmates of infected houses have been divided.

(1) Living at Home or engaged in Home duties
(2) Attending School
(3) Engaged in daily work away from Home

- 🟧 *Cases of Small Pox "at Home"*
- ☐ *Other inmates*
- 🟧 *Cases of Small Pox "at School"*
- ▦ *Other inmates*
- 🟥 *Cases of Small Pox "at Work"*
- ▦ *Other inmates*
- ■ *Fatal cases in each group.*

TABLE XXXIII.—*continued.*

—	FEMALES.					
	Under 1 year.	1 to 10 years.	10 to 30 years.	30 and over.	Age not ascertained.	Total.
At home:—						
Housewife - - -	—	—	49	73	2	124
Of no occupation - -	15	48	29	2	—	94
Engaged in trade, &c. - -	—	—	14	8	1	23
At school - - - -	—	58	25	—	—	83
At work:—						
Mill or factory - - -	—	—	111	13	—	124
Rag sorter - - -	—	—	37	2	—	39
Other occupation - -	—	—	13	3	—	16
Occupation not ascertained -	—	—	2	—	—	2
Workhouse inmates - -	—	—	3	—	—	3
Total - - -	15	106	283	101	3	508

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In *Chart* IV.* there is represented, diagrammatically the relative proportions of the inmates of the 544 invaded houses, of which particulars were obtained, who were residing "at home" in one capacity or another throughout the day, or were in daily attendance "at school," or engaged "at work" away from home. The diagram also shows the numbers of those under each of those sections who were attacked with small-pox. The figures are:—

At Home.

Total number of inmates - - -	1,155
Number attacked by small-pox - -	305
Proportion of inmates to cases - -	3·7 : 1

At School.

Total number of inmates - - -	593
Number attacked by small-pox - -	151
Proportion of inmates to cases - -	3·9 : 1

At Work.

Total number of inmates - - -	1,252
Number attacked by small-pox - -	431
Proportion of inmates to cases - -	2·9 : 1

This analysis shows that the liability to attack, owing doubtless to greater opportunity of exposure, was above the average (3·3 : 1) in the cases of those engaged at work, and slightly below it in the other two series.

e of
l-pox.

Respecting the type and mortality of the disease, the cases fall under the following heads, viz:—

—	Cases.	Deaths.
Confluent - - - -	273	105
Coherent - - - -	125	—
Discrete - - - -	333	3
Mild - - - -	283	—
Type not determined - -	15	2

General sketch of outbreak.

They may be tabulated according to age periods as follows:—

Type and mortality with reference to age.

TABLE XXXIV.

—	Confluent.		Coherent.		Discrete.		Mild.		Indeterminate.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year -	20	18	2	—	3	—	3	—	1	1	29	19
1 to 10 years -	76	35	24	—	42	3	48	—	4	—	195	38
10 to 30 years -	130	33	75	—	194	—	157	—	5	—	560	33
30 years and upwards.	46	19	23	—	93	—	73	—	3	1	238	20
Age not ascertained.	1	—	1	—	1	—	2	—	2	—	7	—
	273	105	125	—	333	3	283	—	15	2	1,029	110

The study of these figures shows that the proportion of *confluent* cases at all ages was 26·5 per cent.:—

Under 1 year of age - - -	69· per cent.
From 1 to 10 years - - -	38·9 ,,
From 10 to 30 years - - -	23·2 ,,
30 years and upwards - - -	19·3 ,,

The proportion of *coherent* cases at all ages was 12·1 per cent.:—

Under 1 year of age - - -	6·9 per cent.
From 1 to 10 years - - -	12·4 ,,
From 10 to 30 years - - -	13·4 ,,
30 years and upwards - - -	9·6 ,,

The proportion of *discrete* cases at all ages was 32·3 per cent.:—

Under 1 year of age - - -	10·3 per cent.
From 1 to 10 years - - -	22·5 ,,
From 10 to 30 years - - -	34·6 ,,
30 years and upwards - - -	39· ,,

The proportion of *mild* cases at all ages, was, 27·5 per cent.:—

Under 1 year of age - - -	10.3 per cent.
From 1 to 10 years - - -	24·6 ,,
From 10 to 30 years - - -	28· ,,
30 years and upwards - - -	30·7 ,,

Or again, of the whole number of *confluent* cases at all ages:—

7·3 per cent. were under 1 year of age, with a mortality of 90 per cent.

27·8 per cent. were at ages of from 1 to 10 years, with a mortality of 46·6 per cent.

47·6 per cent. were at ages from 10 to 30 years, with a mortality of 25·2 per cent.

16·8 per cent. were at ages of 30 years and upwards, with a mortality of 41·3 per cent.

Of the *coherent* class:—

1·6 per cent. were under 1 year of age.

19·2 per cent. were at ages 1 to 10 years.

60 per cent. were at ages 10 to 30.

18·4 per cent. were at ages 30 years and upwards.

Of the *discrete* class:—

0·9 were under 1 year of age.

12·6 per cent. were at ages 1 to 10 years.

58·2 per cent. were at ages 10 to 30 years.

28 per cent. were at ages 30 years and upwards.

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* *Explanation of Chart IV.:—*
In this chart the 3,000 persons dwelling in 544 infected houses are grouped according to their daily occupations, viz., into three classes (indicated by different shades of colour)—of those engaged (a) *at home,* (b) *attending school,* (c) *employed at work away from home.*
The first group comprises 1,155 persons, 305 of whom were attacked with small-pox, and 49 died.
The second group, 593 persons, 151 attacked, 13 died.
The third group, 1,252 persons, 431 attacked, 21 died.
There being thus 887 attacked out of a community of 3,000 members, 83 being fatal attacks.

General sketch of outbreak.

Of the *mild* class :—

1· per cent. were under 1 year of age.
16·9 per cent. were at ages 1 to 10 years.
55·4 per cent. were at ages 10 to 30 years.
26 per cent. were at ages 30 years and upwards.

From which it appears :—

1st. That the age-period of 10 to 30 years afforded not only the absolutely largest number of the cases of small-pox, but of each of the four types of the disease.

2nd. That whereas in the mild and discrete forms the age-period of 30 years and upwards afforded absolutely more cases than the age-period of 1 to 10 years, the reverse was the case as regards the coherent and confluent types.

3rd. That by far the fewest cases in each series, were in the age-period "under 1 year."

4th. In contrast to the foregoing we find that whereas in each age-period the coherent type furnished the fewest cases in the two periods below 10 years the confluent cases were in greatest excess in these periods, whilst in the two periods, from 10 years upwards, the discrete cases predominated and the proportion of mild cases was in excess of that of the confluent.

5th. The absolute mortality was highest in the second age-period (1 to 10 years), but by far the highest relative mortality was among the infants under 1 year of age.

It will be necessary to revert to these figures when the question of the influence of vaccination comes to be considered.

Isolation provisions.

It will be seen subsequently that whereas in Dewsbury all the patients, with five exceptions, were treated in hospital, a considerable proportion of the Batley cases could not be so isolated. In the early months of the outbreak most of the cases were indeed removed to the Workhouse Infirmary at Staincliffe, but when this was closed to small-pox in November, by order of the Local Government Board, the temporary Small Pox Hospital at Batley did not exist. This hospital began to receive patients in January, but it was not until the middle of March, after the buildings had been extended, that it could afford accommodation sufficient for all cases. Hence, from November to March, the majority of the Batley patients had to be treated in their own homes. As regards the other districts, the boroughs of Ossett and Morley had their own provision for isolation, and the rest availed themselves of either the Dewsbury or Batley hospitals; but a certain number of the cases (more than one-fourth), were cared for in their own dwellings.

Taking as before, the whole number of cases under review, it appears that :—

355 were treated at home.
639 ,, ,, in isolation hospitals.
35 ,, ,, in the Union Workhouse Infirmary,

Of the first group, 33 died, a mortality of 9·3 per cent.

Of the second group, 68 died, a mortality of 10·6 per cent.

Of the third group, 9 died, a mortality of 25·7 per cent.

These figures must not, however, be taken to show the comparative value of the different places of treatment, for the "workhouse" mortality is considerably heightened by the fact that three out of the nine fatal cases, were already patients in the infirmary when attacked with small-pox; and I think it is also a fact, that when a choice had to be made, from insufficient accommodation for all cases, those who were most ill were removed to hospital, and the others left at home.

Analysed according to age-periods the destiny of the cases may be thus summarised :—

Under 1 *year of age.*

18 were kept at home - - -	12 died, or	66·6 per cent.
10 were sent to hospital - -	6 ,, ,,	60·0 ,,
1 was sent to workhouse infirmary -	1 ,, ,,	100·0 ,,
29	19	

From 1 *to* 10 *years.*

53 were kept at home - - -	11 died or	20·7 per cent.
134 were sent to hospital - -	25 ,, ,,	18·5 ,,
7 were sent to workhouse infirmary -	2 ,, ,,	28·5 ,,
194	38	

From 10 *to* 30 *years.*

197 were kept at home - - -	8 died, or	4· per cent.
344 were sent to hospital - -	20 ,, ,,	5·8 ,,
20* were treated at workhouse infirmary - - - -	5 ,, ,,	25· ,,
561	33	

From 30 *years upwards.*

85 were kept at home - - -	2 died, or	2·3 per cent.
146 were sent to hospital - -	17 ,, ,,	11·6 ,,
7 were sent to workhouse infirmary	1 ,, ,,	14·2 ,,
238	20	

* Including 6 inmates of whom 3 died.

Whilst of the 7 cases whose ages were not ascertained, 2 were left at home, and 5 sent to hospital.

It will be observed that as would naturally be expected, a much larger proportion of infants were left at home than of patients at other ages, the per-centages being :—

—	At Home.	At Hospital.	At Workhouse Infirmary.
At all ages - - - -	34·6	62·	3·4
Under 1 year - - -	62·1	34·5	3·4
1 to 10 years - - -	27·3	69·	3·6
10 to 30 years - - -	35·1	61·3	3·5
30 years and under - -	36·3	60·7	3·

PART III.

Small-pox at Batley, 1891-2.

In this part I propose to give an account of the origin and progress of the epidemic in each of the districts invaded by small-pox up to the date of my inquiry, viz.:—In Batley, Dewsbury, Birstal, Heckmondwike, Liversedge, Mirfield, Morley, Ossett, Ravensthorpe, Soothill Nether, Soothill Upper, and Thornhill. As the disease first appeared in Batley, and the cases were most numerous there, I shall consider that borough first, and shall deal statistically in turn with—(*a*) Batley, (*b*) Dewsbury, and (*c*) the other infected districts (collectively). It must be borne in mind that the epidemic which commenced in April 1891 and had been most marked in the months January to March 1892, was manifestly subsiding when my inquiry commenced. I have, however, done my best with the data at my disposal to give a connected account of its earlier history.

BATLEY.

Cases of small-pox notified in period of inquiry—History of origin of outbreak—Chapel Fold cases—The Union Workhouse Infirmary at Staincliffe—Cessation of outbreak in September 1891—*The second outbreak—early cases—Invaded houses and their inmates—Numbers invaded in each month—List in order of invasion—The weekly incidence of cases of small-pox—monthly prevalence—Age and sex distribution—Analysis of households in relation to case incidence—Attack rates at different age periods—Occupations of those attacked—and of the members of* 267 *infected houses classified—Relative incidence of the disease upon those* (*a*) *at home*—(*b*) *attending school*—(*c*) *at work. Type of attacks—proportion of confluent, coherent, discrete, and mild cases. Measures of isolation—Monthly and weekly return of cases removed from home and those detained there during illness. Age and sex in these two classes—Analysis of "single" and "multiple" cases in households with respect to isolation—The multiple class divisible into three series, according as one or more were removed. "Initial" cases and "later" cases—Vaccination statistics—Weekly incidence in the various classes of vaccinated and unvaccinated subjects—Age analysis—Mortality—Relation to type of small-pox—Proportions of each class among inmates of invaded houses—and attack rates at various ages—Previous attacks of small-pox—The statistics of vaccination amongst the inmates of houses yielding single and multiple cases—in reference to isolation measures.—Detailed list of households, with respect to vaccination of their members.*

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During the period covered by this inquiry, viz., the seventy weeks ending August 27th, 1892—there were known to have occurred in Batley 545 cases of small-pox.* These cases came from 327 different dwellings, and one case arose at the small-pox hospital.

The first person known to be attacked was H. W., 22 years of age, a "minder" in one of the largest woollen factories in Soothill. His illness began on April 30, 1891, the variolous rash (discrete) appeared on May 2nd, the case was notified to the medical officer of health and removed to the workhouse infirmary on May 7th, where he remained until July 1st. The patient lived in Harrison's Yard, at the foot of Dark Lane, Batley, whence another case was removed (No. 298), much later in the epidemic (Feb. 14, 1892). He was vaccinated, as also were the other members of his family, viz., W., W. the father, æt. 48, H. W., 20, and F. W., 18., brothers. The father and F. W. worked in the same mill as the patient. The origin of the attack could not be traced.

The next case notified was E. M., 22 years, a female "rag-picker" at the same mill as No. 1. She sickened on May 3, and was removed to the workhouse Infirmary on May 12, where she remained until June 26. She came from 5, Pearson Street, in the centre of town, a two-roomed dwelling, without free ventilation, in bad repair, but kept clean. There was an indifferent privy-midden at the back with covered ash-pit; the wall of same was damp from defective roof-drains, and a butcher's slaughter-house was situated opposite. The rent was 3*s*. 3*d*. per week. This tenement was occupied by three other persons besides the patient; viz., Mr. and Mrs. B., the one a cloth finisher, the other a rag-picker; and their child, M. A. B. (unvaccinated), who was attacked by small-pox on May 23, removed to the workhouse on the 26th, where she died on the 30th (No. 4). No other cases occurred in this neighbourhood.

It is not unlikely that the first two cases were exposed to the same source of infection. This was not traceable to any antecedent case, and may have been conveyed by the rags used in the trade. At the same time it is noteworthy that no other cases occurred in workers at this mill for some months (December 1891).

The next case known was that of an infant five months of age living in High Street. He sickened on May 11th and died on the 14th, and Dr. Stewart reports that the child was unvaccinated. The parents had left the neighbourhood, and no information was available as to the possible source of infection in this case.

A series of cases next occurred on the high ground near Staincliffe off the Halifax Road, near the westernmost boundary of Batley, and the Union Workhouse. The first of these (No. 11) was a youth, J. G., who was attacked on May 25. He worked in H.'s mill in Dewsbury, but at this time no cases were known to have occurred in that borough and the origin of his illness is unexplained. He lived with five others (aged from 77 to 22) in a small two-roomed "back-to-back" tenement in Chapel Fold, and was nursed at home by his mother. She alone kept to the house, the others employed at various mills "went about as usual." Only two of these people had been vaccinated, the rest, including the patient, were un-vaccinated. On June 7, M. B., a girl of 15 (No. 5), living at 39, Chapel Fold, and working at F.'s mill, which adjoins the workhouse, was attacked, *i.e.*, on the 14th day of the earliest symptoms in the previous case. She was removed to the workhouse infirmary on June 12th, where she remained until August 14th. It may be presumed she contracted the disease from No. 11, for it is hardly likely that she was infected (aerially) by the proximity of her workplace to the infirmary which at that time (*i.e.*, about May 12) only contained one small-pox case. It may be mentioned here that the first case notified in Dewsbury was a worker in this same mill. He sickened on June 14, only eight days after the foregoing case of M. B., who, however, besides contracting the disease herself may well have been the medium of contagion to this lad, from the infected area in which her home was situated. On the whole this seems more probable than infection from the infirmary, which at that date (*i.e.*, about June 1) contained two cases of small-pox, one having died on May 30. (*See* later, "Dewsbury" section.)

Other cases in Chapel Fold were members of one household, a man named S. P., æt. 35, a gardener, with a wife and a family of five children, the oldest ten years of age, and the youngest two months old when her mother was attacked with small-pox on June 10. She was probably infected on May 28, three days after the first case occurred in this area. She was not taken to the infirmary until July 4, when her infant was removed there, and her husband also, the one sickening on June 30, the other on July 3rd. The infant (who was un-vaccinated) died on July 8th. The four other children were removed to the workhouse for quarantine at the same time; they had all been vaccinated in infancy, and none of them took the disease. The house inhabited by this family was an old low-roofed building and contained only two rooms. There was thorough ventilation, but the cleanliness and repair of the place were very moderate. A midden shared by the next house was situated about ten yards from the dwelling and had an open ash-pit.

Another case in this vicinity is that of G. B., a youth 17 years of age, living in Newsome's Yard, Chapel Fold, engaged in the co-operative grocery stores in the main road hard by. He was attacked on June 12th, and was nursed at home by his mother and sister, who were re-vaccinated on the day that his rash appeared, whilst his brother, the only other inmate of the house, was sent away from home. It was thought that he might have been infected in his shop by folk coming there from infected houses. The house, a back-to-back one, is well kept; but there is in the yard a defective privy-midden with a large and foul open ash-pit.

Chapel Fold is situated on the northern side of the Halifax Road about 800 feet from the workhouse. On the opposite side of the same road, about 500 feet from the workhouse, a large mill reservoir and field intervening, are two or three comparatively new rows of houses. In one

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* All but 12 of these cases were notified to the Medical Officer of Health. There were also four other cases notified as small-pox, but presenting such ill-developed symptoms as to justify their exclusion from the list. Four other cases (Nos. 127, 149, 371, 485 in register) notified as small-pox proved on inquiry to be cases of varicella; two of them subsequently contracting small-pox. One of these (No. 371) was re notified (No. 452 in register); the other (No. 485) was re-admitted to hospital without fresh notification.

Small-pox at Batley, 1891-2.

of these, Cullingworth Street, a young married woman, J. A., in third month of pregnancy, fell ill of small-pox on June 8th. She was removed to the workhouse infirmary on the 12th and died there on the 17th. Her husband, a soldier, being away, she lived with her parents Mr. and Mrs. C., who had five other children at home. The house, which is a back-to-back one, has three rooms, and did not seem to be well kept. It is uncertain where J. A. contracted the disease. At the time of her presumed infection (about May 26) there were three cases of small-pox in the workhouse infirmary: but it is hardly probable that she was infected by them. Nevertheless another case (No. 7) a man, aged 40, occurred in a neighbouring house in the same street, on June 10, this case being left at home but no precise information as to his infection is available; and a third (No. 8), in a back-to-back house on the main road close to Cullingworth Street, a female child, two years of age, who sickened on June 12, and was taken to the workhouse infirmary on June 15, where she stayed until August 8. This child was un-vaccinated, as also was her sister, æt. 9, but the other inmates of the house, the parents, had been vaccinated in infancy. The house contained two rooms, was well kept and clean; and the privy was situated in a back yard, and was shared by three other households.

On June 12th there also fell ill a young woman, L. W. (No. 12) living in Upper North Street, also on high ground in a newly built over district in the same direction as Staincliffe. She was removed to the workhouse infirmary on June 15, and died there on the 18th. She was a weaver, but as the family had removed, I could get no information as to where she worked. The source of her infection cannot be surmised.

In July two fresh cases were notified in the borough. One was that of a lad, C. T., 15 years of age (No. 15), employed by a newsagent to carry papers to customers, and amongst others to Mr. P. at Chapel Fold. The lad sickened on July 25, and must therefore have been infected on or about July 12, a week after all the P. family had been taken to the workhouse. He was nursed at home by his mother, æt. 38 (who had small-pox in 1863, when it prevailed in Batley*), being kept in the dwelling room downstairs. The five other members of the family, all of whom had been vaccinated in infancy, were quarantined in the upstairs room. The house is in Track Quarry, has no through ventilation, a dead wall behind, the privy and ash-pit accommodation is bad, and is situated in a narrow passage at the back of the row of houses. No other case occurred in this house. On July 29, R. W., 20, a butcher, living at Clay Hill, a few yards from the first case noted in Batley, was attacked with small-pox. He was left at home and one other of the six inmates, G. L., 17, a maid servant, fell ill on August 15. She was un-vaccinated, and had a confluent attack lasting for five weeks. A third member of this household, G. W., brother to the first case, a youth of 16 years, was notified as having small-pox, but the evidence of this seems to be too slight to justify the retention of his case in the list. As to the infection of R. W., his trade would perhaps afford him opportunities of coming into contact with persons from infected houses. Another case, Mrs. W., æt. 46, occurred in this neighbourhood on August 13, and was also kept at home; but I could obtain no particulars of her illness and surroundings.

In August one other fresh house was invaded, not far from Track Quarry, in Victoria Street, Batley Carr. On August 2nd, Mrs. C., æt. 53, was attacked, and was left at home during her illness. The house is a four-roomed one and has thorough ventilation. Mrs. C. lives at home, having retired from business; and the four children, ranging in age from 25 to 17, are employed, one as manager of a grocery store, another as a plumber, and two as weavers. These latter, aged respectively 23 and 19, also contracted small-pox, one (No. 21) falling ill on August 18th, the other on August 23rd. All had mild attacks. Another member of the family, G. W., æt, 25 (No. 238), caught small-pox in January 1892.

In September two children (æt. five and seven respectively) of one family living at Back Chapel Street, were notified, but I could get no particulars, as they had left the neighbourhood. They had mild attacks, and one had nearly convalesced when the second fell ill and was attended by a medical man who notified both cases on September 16.

No other cases occurred in Batley until November.

It may be useful here to summarise the chief facts of this early outbreak, especially as it marks the first appearance of small-pox in the Dewsbury Union since 1888.† Whether the disease was imported by rag-infection or not cannot be determined with certainty. That the first to be attacked were workers in a mill where there is a large consumption of rags of all kinds does not of course prove that they were infected through rags, although one of them was a rag-picker. That they should have fallen ill within a few days of each other is suggestive of their having been exposed to a common source of infection; but this may have been an unsuspected case, just as much as an infected bale of rags, especially if the large numbers exposed to infection from the latter source be considered. It must also be remembered that a large proportion of the adolescent and young adult population of Batley are employed in rag-picking and wool-weaving, so that the incidence of the disease on members of their class does not of necessity imply that it was contracted in their work.

Batley being at that time unprovided with a separate isolation hospital took advantage of the practice which had been long customary, of sending these two cases of small-pox to the infectious wards of the workhouse infirmary at Staincliffe. In speaking of Dewsbury I shall mention that certain inmates of this Infirmary contracted the disease shortly after the admission of these cases; and it has been seen above that some of the earliest infected centres were in the vicinity of the workhouse (*see* plan*). I shall refer in more detail to the former point when speaking of Dewsbury; but as regards the latter I may state at once that there is no evidence, but rather the contrary, that the infection of the Chapel Fold and Cullingworth Street cases was from the infirmary. The disease appeared in Chapel Fold on May 25, and the exposure to infection must therefore have been at a date corresponding to the removal of the second Batley case to the workhouse infirmary. I cannot say whether there is any relation at all between these cases, but it may, I think, be confidently averred that the appearance of the disease in this part of the borough was followed by its introduction into Dewsbury. This was, indeed, inevitable, for small-pox does not respect municipal boundaries, no more than do the workers in a mill necessarily reside in the district in which the mill is situated.

During the five months—May to September 1891—there were notified 24 cases of small-pox within the borough of Batley. The doubtful character of one of these cases has led me to eliminate it from the list. This leaves 23 cases which came from 14 different houses. Nine of these patients were sent to the workhouse infirmary of whom four died; twelve were left at home, one of whom died.

Although cases of small-pox continued to be notified almost every week in Dewsbury, it is remarkable that with the exception of the two children in Back Chapel Street, notified in September, no other cases were known to the Batley authorities until the third week in November. Then notifications began to occur again, viz.:—one on the 21st, four on the 24th, three on December 4th, one on the 5th, two on the 6th, three on the 7th, four on the 9th, and one on the 11th. But these cases came from only eight infected houses, at least three of which were inhabited by families who were inter-related.

The number of cases notified every month from this date onwards, was December, 61; January 1892, 167; February, 136; March, 86; April, 33; May, 21; June, 0; July, four, August, three. As stated, eight of these proved not to be small-pox, whilst cases of that disease which were not notified occurred six in January, two in February, two in March, two in April.

On November 21st, 1891, the case of D. B. was notified. He is a millowner living in Dark Lane, and was taken ill on November 18th (No. 25). He said that about a fortnight before he visited a neighbour, Miss H., who was feeling ill, complaining of headache and backache, but she had no medical attendance, and I could not ascertain whether she had any rash. The possibility of his having contracted the disease in the course of his business through handling infected rags was mooted, but could not be sustained, as he had no transactions in those articles a fortnight previously. His last purchase of rags was in Batley on October 19th. His wife, C. B. (No. 30), was attacked on December 1st (*i.e.*, 14th day of his illness). Both were mild attacks, D. B. having very slight eruption. There were two children, aged four and one year respectively, both vaccinated, the elder being re-vaccinated unsuccessfully. It is noteworthy that C. B. was successfully re-vaccinated (three insertions) on November 19th, practically simultaneously with her infection.

On the same day (so far as can be gathered from inquiries made at the several households), that D. B.

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* Mrs. T. told me that on that occasion, out of a family of five, three children (herself, a sister, and brother) and the father had small-pox. The children were unvaccinated, vaccination not then being compulsory.

† I have already pointed out that the first cases in the West Riding occurred in Leeds.

* I am indebted for this plan to the Borough Surveyor, Dewsbury; it is based on a survey made several years ago, before the extension of F.'s mill and the construction of Cullingworth Street. These additions I have ventured to make, of course, approximately; and have indicated the fever block by the red tint.

sickened, two cases occurred in two families who were related. One of these was an infant, C. T., æt. three months (No. 28), living in Brearley Street (off Dark Lane), who was taken into Batley by her mother about two weeks previously, but did not visit anywhere. The infant who was about to be vaccinated was noticed by the mother to have some "spots" out on the same day that she sickened (Nov. 16), but no medical man saw her until the 21st, and he notified the case on the 24th. The child died on the 30th. Another infant, 18 months old, R. T., who had been vaccinated 12 months previously by the public vaccinator, and whose arm presented three closely aggregated foveate scars, did not contract the disease. The house was a small one containing one bedroom and one sitting room, and was one of a row at the corner of a small passage leading to a yard enclosed on three sides by houses, and containing an ill-kept privy-midden, about three yards distant from the building. This tenement was occupied by Mr. and Mrs. T. (who had both been vaccinated in infancy) and their two children as above. It received another inmate on December 1st from Hume Street, in the person of the infant E. B., aged 15 months, whose mother, E. B., was removed on that date to the Union Workhouse, suffering from small-pox, which she had contracted from her brother, A. B., æt. 14, a hurrier at Howley Park Pit, who sickened on the same day as C. T., viz., November 16. The infant E. B. (who was un-vaccinated), was removed to the workhouse on December 12, and died there on December 20th (No. 504).

Meanwhile, a series of cases were occurring in the members of other households related to the foregoing, commencing in the family of a married brother of E. B. and A. B., with the illness of his un-vaccinated child, S.E.B., æt. seven months (No. 27), who was attacked on November 21, and died on the 29th. This family occupied a house in Dark Lane, a few yards from that of D. B., who was attacked on November 16th. This house, although a back-to-back one and consisting only of two rooms, was clean and well kept. The parents, C. B. and E. B., were both attacked with small-pox on December 4th (Nos. 35 and 32).* There were two other children, R. B. æt. seven, and M. E. B. æt. three, who were taken by Mrs. W. (mother of E. B.) to her house in Hume Street, when their parents developed the disease. It would appear, however, that the W. family were already infected (probably from the other branch of the B. family living in Hume Street, and already mentioned), for on December 7th and 9th three cases were notified in this house, viz.:—E. W., æt. 35, A. W., æt. 15, and B. W., æt. four (Nos. 38, 42, 41). So far as we could determine, these fell ill on December 6; whilst another, M. W., æt. 19, was attacked on December 18 (No. 505). The household consisted of nine members, the father, a miner, and also two sons, a daughter and a cousin, and another son and daughter attending school. All were discrete attacks, one only, the youngest, being un-vaccinated. The whole family together with the two B. children were removed to the workhouse; the cases of small-pox being taken to the fever block, and the rest kept in quarantine in the workhouse. One of the B. children (viz. M. E. B., æt. three years—No. 36) had a mild attack, but R. B. escaped.

Another family to be attacked about the same period was that of R. living in Colbeck Buildings, Mount Pleasant, a court containing a large number of back-to-back two-roomed tenements, on high ground. The family in question consisted of six members, the first to be attacked being S. A. R., æt. six, a schoolgirl, un-vaccinated, attacked on the 24th November, left at home and died on December 11th (No. 26); her mother, M. A. R., æt. 30, was removed to the workhouse infirmary on December 9th (No. 34); followed on the 10th by her husband, J. R., æt. 30, and eldest child, M. E. R., æt. eight (Nos. 39, 40). The other two children, aged four and three respectively, were removed to the workhouse at the same time, but not developing the disease, were returned to their homes.

Thus several infected centres were established in the town, and as most of the class amongst whom the disease occurred were engaged either in mills or coal pits, or were attending day school, the disease soon gained a foothold, whilst as the majority of cases were nursed at home, the opportunity for spread was considerable.

It would be impossible to follow the course of the epidemic in any connected way. Suffice it that Hume Street and the neighbouring streets in the heart of Batley, viz.:—New Street, Peel Street, Cobden Street, Providence Street, suffered largely, and Colbeck Buildings, Billcliff Buildings, &c. disproportionately to the number of dwellings contained in their areas. Cases occurred in Hume Street from November 16 to April 10; in New Street from December 29 to March 7; in Cobden Street from January 3 to March 28; in Providence Street from January 6 to April 22; in Colbeck Buildings from November 24 to January 30; Billcliff Buildings, December 11 to January 12; Alma Terrace, December 21 to January 2; Peel Street, December 31 to March 23.

Small-pox at Batley, 1891–2.

Batley is mainly built on the two sides of the valley along which runs the Batley Beck, a stream fouled by many mills. The Bradford Road, which is the main road between Dewsbury and Batley, runs down the valley turning from a line running nearly due north and south to one from east to west. Adjoining Dewsbury is the district known as Batley Carr mainly to the west of this road, with streets rising upwards towards the high ground of Staincliffe and Mount Pleasant. On the east of this road from Dewsbury are the Batley sewage works and several large factories; whilst as it turns to the west, on the way towards Birstal, it encloses the most densely-peopled and lower parts of the town between Commercial Street and Wellington Street, which are separated by the wide space in which the Market Hall stands. Running between Wellington Street and Commercial Street are a series of parallel streets, Providence, Cobden, Peel, New, and East Streets, where a large proportion of the cases of small-pox occurred. At the western extremity of Wellington Street, a road runs in a south-easterly direction—Purlwell Lane—towards the high ground about Mount Pleasant, and another westwards to Clerk Green and Dark Lane, an open thoroughfare with houses only on one side running southwards, and rising towards Staincliffe. At the foot of Dark Lane are Clayfold and Harrison's Fold where the first case of small-pox occurred, and round to the north-west, are a few streets, including the poor district of Woodwell which adjoins the cemetery, beyond which is Carlinghow. The part of Batley to the north of the Bradford Road is on the summit of a steep hill; it is mostly residential and but few cases occurred here; it leads to Upper Batley, and the open country between Batley, Morley and Birstal.

Sanitary Conditions of the Houses invaded by Small-pox.—In the inquiry made by Mr. Fardon and myself, certain particulars were noted as to the sanitary state of each of the houses we had occasion to visit, and in the tabulated lists that follow, the house is referred to by a numeral indicating its place in the register that was kept by us. The main points, and such as can be treated in a general manner, may be summarised as follows:—

Class of houses invaded by small-pox.

Of 266 houses,* in which details as to sanitation were noted, 95 were so constructed as to have some through ventilation, either complete with back doors and windows, or partial; as, for instance, by means of one or more back windows only. The remainder, 171, had no through ventilation.

Through Houses.—Six of these were detached dwellings; 12 were connected with retail shops. In 79 the through ventilation was complete; in 16 it was partial. The total number of rooms in these 95 houses amounted to 412 (of which 216 were sleeping rooms); and they were inhabited by 530 persons, giving a proportion of 1·3 (nearly) per room. There were 158 cases of small-pox in these houses, giving a proportion of all inmates to the attacked of 3·3 : 1. In other words, at this rate 100 houses of this type would yield 166 cases.

Not Through Houses.—These include 122 "back-to-back" houses; 42 "single" houses, and seven "cellar-dwellings," containing in all 404 rooms (of which 224 were used as sleeping rooms) for a total of 921 inmates, or a proportion of 2·2 per room. In these 171 dwellings there were 305 cases of small-pox, *i.e.*, a proportion of inmates to cases of 3 : 1. In other words, at this rate 100 houses of this type would yield 178 cases.

Excrement Disposal.—It may be of interest to note that of the "through" houses, 82 were connected with privy middens (nine noted as "bad," six as "indifferent," the ashpits being uncovered in nine); nine were served by the "trough watercloset"; three by the pail system; and in one there was a watercloset in the house. Of the "not through houses" 159 were connected with privy middens (31 noted as "bad," 16 as "indifferent," nine having open ashpits); 10 used trough waterclosets, and two had the pail system.

The following table is a list of all the houses known to have been invaded by small-pox within the period covered by this report. They are arranged in order according to the date at which the disease appeared in the household. The total number of inmates of each house is given under the four categories of those "under 1 year," "1 to 10 years," "10 to 30 years," and "30 years or upwards." The same division is made for the cases of small-pox arising in those families which are indicated by the numbers that refer to the register of cases.

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* The case of the mother is interesting, for she was suckling her infant at the time, and was inoculated on the right nipple and shoulder, the general rash appearing four days after these spots.

* No record of No. 22.

Small-pox at Batley, 1891–2.

BATLEY.

LIST of HOUSES INVADED by SMALL-POX, with NUMBERS and AGES of INMATES, and REFERENCE to the REGISTER of CASES.

*Date of Invasion of Small-pox.	Name of Street or Court.	Reference to House Register.	Inmates of House.				Cases of Small-pox.†			
			Under 1 year.	1 to 10.	10 to 30.	30 and upwards.	Under 1 year.	1 to 10.	10 to 30.	30 and upwards.
1891.										
1. April 30	Harrison's Fold	138			3	1			1	
2. May 3	Pearson Street	224		1	1	2		**4**	2	
3. „ 11	High Street	—	—	—	—	—	**3**			
4. „ 25	Chapel Fold	238			2	4			11	
5. June 7	Chapel Fold	239			2	2			5	
6. „ 8	Cullingworth Street	268		1	5	2			**6**	
7. „ 10	Cullingworth Street	—	—	—	—	—				7
8. „ 10	Chapel Fold	266	1	3	1	2	**14**			10, 13
9. „ 12	Staincliffe Road	269		2	1	1		8		
10. „ 12	Chapel Fold	267			3	1			9	
11. „ 12	Upper North Street	—	—	—	—	—			**12**	
12. July 25	Track Quarry	246		2	2	3			15	
13. „ 29	Clay Hill	136			5	1			16, 19	
14. August 2	Victoria Street, Batley Carr	245			4	2			21, 22, 238	17
15. „ 13	Clayfold	—	—	—	—	—				18
16. Sept. 6–13	Back Chapel Street	—	—	—	—	—		23, 24		
17. November 16	Dark Lane	1		2	1	1			30	25
18. „ 16	Brearley Street	3	1	2	2		**28**	**504**		
19. „ 16	Hume Street	22			4	1			**29**, 31	
20. „ 24	Colbeck Buildings	214		4		2		**26**, 40		34, 39
21. „ 24	Dark Lane	131	1	2	2		**27**	36	35, 32	
22. December 4	Albion Street	243		2	2	1		33		
23. „ 4	Colbeck Buildings	215			3	1			75	66
24. „ 6	Hume Street	31		3	4	2		41	42, 505	38
25. „ 6	Dark Lane	2			2	2			43, **45**	
26. „ 6	Henrietta Street	226		1	3	2			58	
27. „ 9	Hume Street	—	—	—	—	—		46		**174**
28. „ 9	Grosvenor Cottages	—	—	—	—	—			49	
29. „ 10	Dark Lane	129		2	1	2		44		
30. „ 10	Ward's Hill	—	—	—	—	—			47	
31. „ 10	Norfolk Street	70		1	3	4				56
32. „ 11	Clayfold	135		3	3	2			48, 83	84
33. „ 11	Billcliff Buildings	—	—	—	—	—				**51**
34. „ 11	Colbeck Buildings	211		4	4	2		64	52, 53, 63	
35. „ 11	Upton Terrace	291			2	2			54	
36. „ 11	Wheatcroft	—	—	—	—	—			59	
37. „ 12	Clerk Green	127	1	4	3	2	201	187, 188	50, 109, 189	
38. „ 12	Cheapside	258		1	3	3			55, 236	142
39. „ 12	Dark Lane	132		3	2				57	
40. „ 12	Hanover Street	—	—	—	—	—			60	
41. „ 13	Crescent Street	—	—	—	—	—				61, 89
42. „ 13	Dark Lane	—	—	—	—	—				62
43. „ 13	Clerk Green	68			2	2				68
44. „ 13	Heaton's Yard	288			1	1				71
45. „ 15	Colbeck Buildings	209		4	2			**65**	108, 516	
46. „ 15	Billcliff Buildings	191			3	2			**67**	
47. „ 15	Hume Street	52			5	1			86, 129	
48. „ 16	Dark Lane	133			2	3				73
49. „ 17	Hume Street	50	1	3	2	2	104	74	103, 102	
50. „ 18	Union Street	—	—	—	—	—		**72**		
51. „ 19	Clerk Green	66		2	2	2				70
52. „ 19	North Parade	203	1	1	5	2		111	76, 112, 185	
53. „ 20	Queen Street	170		2	5	1	69		404	
54. „ 23	Hume Street	—	—	—	—	—			82	

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* This date refers to the "date of onset" of the first case occurring in the house.
Fatal cases indicated by **black** type.

† The figures refer to the Case Register.

LIST of HOUSES INVADED by SMALL-POX, &c.—*continued.*

*Date of Invasion of Small-pox.	Name of Street or Court.	Reference to House Register.	Inmates of House.				Cases of Small-pox.†			
			Under 1 year.	1 to 10.	10 to 30.	30 and upwards.	Under 1 year.	1 to 10.	10 to 30.	30 and upwards.
55. December 24	Hume Strset - - -	39		1	3	1		80	7 79. 506	77
56. „ 25	Bradford Road - - -	163		1	1	2				81
57. „ 26	Stanley Place - - -	256		2	2	2		85		
58. „ 26	Alma Terrace - - -	124		2	1	1		94, 152	229	
59. „ 27	Cullingworth Street - -	240	1	3	1	2		105		184
60. „ 28	Brown's Buildings - -	—	—	—	—	—		**87**		
51. „ 28	Healey Street - - -	242		1		2				98
62. „ 28	Back Crescent Street - -	111			2	2			139	
63. „ 29	Carlinghow Lane - - -	—	—	—	—	—			88, 202	
64. „ 29	New Street - - - -	74			3	1			90	
65. „ 29	Parker's Place - - -	98			4	2			101, 397, 511	95, 165
66. „ 30	New Scarbro' - - -	260			2				93, 92	
67. „ 30	Oxford Street - - -	248		1	5				99, 100, 182, 195.	
68, „ 31	Grafton Street - - -	—	—	—	—	—			91	
69. „ 31	New Street - - - -	76		4	5	2			96, 180, 340	
70. „ 31	Staincliffe - - - -	—	—	—	—	—				97
71. „ 31	Peel Street - - - -	59			3	1			**116**, 510	
1892.										
72. January 1 -	Hume Street - - -	49		5	3	3		176, 249	106, 315, 331	
73. „ 1 -	Oxford Street - - -	199		2	4	2			107, **278**	
74. „ 1 -	Alma Terrace - - -	126	1	3	3	2				110
75. „ 1 -	Wetherall Street - - -	—	—	—	—	—	**134**		113	
76. „ 1 -	Colbeck Bnildings - - -	218			2	2			114, 514	
77. „ 1 -	King Street, B.C. - - -	117		3	3	1		181, 192	**118**	
78. „ 2 -	Alma Terrace - - -	125			3	1			115, 117	
79. „ 2 -	Woodwell Street - - -	62		2	3	2		119	211	
80. „ 2 -	Charles Street - - -	187		1	2	2		132		
81. „ 2 -	Suffolk Street - - -	73		1	3	2		520	186, 135	
82. „ 3 -	Cobden Street - - -	20		2	4				120, 193	
83. „ 3 -	Billcliff Buildings - - -	195		1	3	2			121	
84. „ 3 -	Providence Street - - -	9				3				122
85. „ 3 -	Colbeck Buildings - - -	210			3	2			123, 512	204 513
86. „ 3 -	Billcliff Buildings - - -	196		2	4	2			124, 126	
87. „ 3 -	Norfolk Street - - -	69		3	1	1		125		
88. „ 3 -	North Parade - - -	201		4	2	2		128		
89. „ 3 -	Colbeck Buildings - - -	212		1	1	3		224	507	231 281
90. „ 4 -	Billcliff Buildings - - -	192			3	1			515	508
91. „ 5 -	Belvedere Road - - -	206	1	5	1	2				130
92. „ 5 -	East Street - - - -	82		2	2	2		233	140	
93. „ 6 -	Providence Street - - -	13	1	1	2	1	**230**		131, 216	
94. „ 6 -	Spring Gardens - - -	144			2	2			133	
95. „ 6 -	Parker's Place - - -	—	—	—	—	—			136	
96. „ 6 -	Charles Street - - -	189		3	4	2			138, 147, 509	
97. „ 8 -	Spring Gardens - - -	85			6	2			141, 422	
98. „ 9 -	Hume Street - - -	278			2	2			137	
99. „ 9 -	Billcliff Buildings - - -	193		1	3	2			143	
100. „ 9 -	Clerk Green - - -	128		1	2	2			144, 308	223
101. „ 9 -	New Street . - - -	75			3	2			145, 190, 227	
102. „ 9 -	Wilton Street - - -	—	—	—	—	—		146		
103. „ 9 -	New Street - - - -	140		4	3	2			150	
104. „ 10 -	Providence Street - - -	11		2	1	2			148	
105 „ 1 -	Woodwell Street - - -	96	1		2	—			151, 269	
106 „ 10 -	Healey Lane - - -	273			6	1			161	
107. „ 11 -	Harrison's Fold - - -	—	—	—	—	—			153	
108. „ 11 -	Dark Lane - - - -	134		1	3	2			154	
109. „ 11 -	New Street - - - -	142	1	2	4	1	**332**	257, 518	**156**	

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* This date refers to the "date of onset" of the first case occurring in the house.

† The figures refer to the Case Register.

Small-pox at Batley, 1891–2.

LIST of HOUSES INVADED by SMALL-POX, &c.—*continued.*

*Date of Invasion of Small-pox.	Name of Street or Court.	Reference to House Register.	Inmates of House.				Cases of Small-pox.†			
			Under 1 year.	1 to 10.	10 to 30.	30 and upwards.	Under 1 year.	1 to 10.	10 to 30.	30 and upwards.
110. January 11	Wheatcroft	185		1	2				158	
111. " 11	Pit Lane	264	1		4	2			160, 159	
112. " 12	Billcliff Buildings	190	1	4	1	1	**149**			
113. " 12	New Street	141			1	3				155
114. " 12	Woodwell Street	—	—	—	—	—		**157**	531	
115. " 12	Dark Lane	—	—	—	—	—			162	247
116. " 13	Commercial Street	231			3	2			163	
117. " 13	Upper North Street	207		1	1	3				191
118. " 14	King Street, B. C.	116			2				164, 377	
119. " 14	Brearley Place	222			2	2			171	
120. " 14	Wilson's Buildings	—	—	—	—	—				172
121. " 14	Brown's Buildings	177			2	2			173, 197	178
122. " 15	Hume Street	23		3	5	2			333	166, 261
123. " 15	Peel Street	54	1		2	2			167	
124. " 15	Grosvenor Cottages	237		2	2				168	
125. " 15	Queen Street	168		3	5	2		287	169, 279, 286, 289.	288
126. " 15	Cobden Street	30			1	Age ? 2			170	
127. " 16	Dale Street, B. C.	149			4	2			175	
128. " 16	Wellington Street	289		1	3	2			177	
129. " 18	Woodwell	71				3				179
130. " 18	Charles Street	—	—	—	—	—			203	194
131. " 18	Purlwell Lane	—	—	—	—	—			198	
132. " 19	Balk Street	102		1	5	1			196, 396, 458	
133. " 19	Peel Street	56				2				200
134. " 20	Cross Bank	113			4	1			**208,** 307, 312	309
135. " 20	Wellington Street	197			2	3				221, 222, 299
136. " 21	High Street, B. C.	155		1	2			452	205	
137. " 22	Jacob Street	87		2	5	2			206, 290, 296, 519.	
138. " 23	Bath Street	262			1	2				207
139. " 23	Cobden Street	17		1	5	2			210	
140. " 23	Newsome's Buildings	180		1	1	Age ? 2			212	
141. " 23	Victoria Street, B. C.	—	—	—	—	—			226, 282	
142. " 24	Back Peel Street	43		1	2				209, 244	
143. " 24	Providence Street	10			2				215	
144. " 24	Providence Street	14		1	3	2				218
145. " 24	Henry Street, B. C.	—	—	—	—	—		225, 304		
146. " 25	Hume Street	37			2				213	
147. " 25	Fox's Fold	285			2				214	
148. " 25	Peel Street	40	1	1	3	2	**334**	**317**	217, 428	
149. " 25	Peel Street	57		2	4	2		**314, 348**	220, 310	239
150. " 25	Bradford Road	280			4	2			237	
151. " 25	Peel Street	42			2	2				250
152. " 26	Russell Street	46		1	2	2			219	
153. " 26	Cobden Street	27	1		3				228, 291	
154. " 26	High Street	183			2				232	
155. " 27	Burnley Mill Fold	173			5	1			234, 313, 319, 320.	
156. " 27	High Street, B. C.	156	1	1	2				235	
157. " 27	Cobden Street	29		1	2	2			240	
158. " 27	Jacob Street	60		1	5	2			241, 370	
159. " 27	Hick Lane	—	—	—	—	—			243	
160. " 27	Sewage Works	162			2				248	
161. " 27	Colbeck Buildings	220	2	2		2				26
162. " 27	Cobden Street	25		1	4	2			264	
163. " 27	Cobden Street	21		2	1	1		329, 337	517	
164. " 28	Jacob Street	92		4	1	1		**245**		
165. " 28	Bright Street	277			4	1				252

* This date refer to the "date of onset' of the first case occuring in the house.

† The figures refer to the Case Register.

List of Houses Invaded by Small-pox, &c.—*continued.*

* Date of Invasion of Small-pox.	Name of Street or Court.	Reference to House Register.	Inmates of House.				Cases of Small-pox.†			
			Under 1 year.	1 to 10.	10 to 30.	30 and upwards.	Under 1 year.	1 to 10.	10 to 30.	30 and upwards.
166. January 28	Cobden Street	19		2	6	2		327	266, 445, 484	525
167. „ 29	Jabob Street	91	2		2	2	**267**		246	
168. „ 29	Commercial Street	230			2	2			251	
169. „ 29	High Street	182			5	2			253, 330	
170. „ 29	Colbeck Buildings	219			5	2			254, 256, 316	
171. „ 29	Brearley Street	204		1		2				255, 301
172. „ 29	Colbeck Buildings	217			4	2			258	
173. „ 30	Colbeck Buildings	213		4		2		259		
174. „ 30	New Street	77				3				260
175. „ 30	Billcliff Buildings	194		1	3	1			263	
176. „ 30	Warwick Mount	—	—	—	—	—				271
177. „ 30	Healey Lane	272			2	3				275
178. „ 31	Purlwell Lane	65			2	1			265	
179. „ 31	Woodwell Street	—	—	—	—	—				270
180. February 1	Hume Street	36	1	2	2		374	273, 366	335	
181. „ 1	Brown's Buildings	—	—	—	—	—			**274,** 455	
182. „ 1	High Street	184		2	1	2				276
183. „ 1	Spa Street	283			4	2			277	
184. „ 1	Staincliffe	241		4	2	2		284		
185. „ 2	Back Taylor Street	164		2	2	2		360	280	272, 30
186. „ 3	Peel Street	58			2				293, 300	
187. „ 4	Ward's Hill	234		1	6	3			283	355
188. „ 4	New Street	143			2	2			285	
189. „ 4	Clayfold	—	—	—	—	—				294
190. „ 4	Flemming's Place	225	1	2	4	2			295	
191. „ 5	Hume Street	51			3	1			292, 373	
192. „ 5	Russell Street	47			2	3			297	
193. „ 6	Wellington Street	282		2		2				302
194. „ 6	Providence Street	12		2	1	2				326
195. „ 7	Derby Terrace, Woodwell	94		2	3	2			303, 352	
196. „ 7	Wellington Street	198		1	5	2			306	
197. „ 8	Harrison Fold	137			1	1			298	
198. „ 10	Back Jacob Street	88		2	1	2		311	369	
199. „ 12	Kent Street	175			3	2			460	321
200. „ 12	Suffolk Street	—	—	—	—	—				325
201. „ 14	Hume Street	33		2		2		318		521
202. „ 14	Albert Square, B. C.	157		2	2	1		322, 323		
203. „ 14	Back Taylor Street	167		2	1	2				324
204. „ 14	Victoria Street	—	—	—	—	—			328	
205. „ 16	George Terrace	253		2		1		402	336, 401	
206. „ 16	Jacob Street	89		3	1	2				342
207. „ 16	Brookroyd Lane	7				2				367
208. „ 17	Bridge Street	257		1	4	2				338
209. „ 17	George Terrace	251			2	1			339	
210. „ 17	New Street	78		4	2	2			341	
211. „ 17	Spa Street	—	—	—	—	—		**400**		**343**
212. „ 18	Taylor Street	165		2	4	2			**346**	
213. „ 19	New Street	79			7	2			344	
214. „ 19	Ward's Hill	233		2	3	1			347	
215. „ 19	Spring Gardens	86			1	1			361	
216. „ 20	New Scarborough	259	1	3	4	2			345	
217. „ 20	Hillborough Road	148				2				349
218. „ 20	Corporation Cottages	271		3	4	2			**350,** 351	
219. „ 20	Talbot Street	172			2	2			353	
220. „ 20	Commercial Street	286			7	2			356	
221. „ 20	Havercroft Fold	—	—	—	—	—			368	

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* This date refers to the "date of onset" of the first case occuring in the house.

† The figures refer to the Case Register.

Small-pox at Batley, 1891-2.

LIST of HOUSES INVADED by SMALL-POX, &c.—*continued.*

Date of Invasion of Small-pox.	Name of Street or Court.	Reference to House Register.	Inmates of House.				Cases of Small-pox.†			
			Under 1 year.	1 to 10.	10 to 30.	30 and upwards.	Under 1 year.	1 to 10.	10 to 30.	30 and upwards.
222. February 21 -	Cobden Street - - -	28	1		2	1			354, 409	
223. " 21 -	Upper North Street - -	208		1	2				357, 423	
224. " 21 -	King Street - - - -	244		2	7	2			358	
225. " 21 -	Commercial Street - -	292			4	2			359	
226. " 21 -	Healey Lane - - -	—	—	—	—	—			363	
227. " 21 -	George Terrace - - -	252			3				365	
228. " 22 -	Peel Street - - - -	48		2	2	1				362
229. " 22 -	Hick Lane - - - -	281	1		2	3				364
230. " 22 -	Crown Street - - -	232			4	1			375	
231. " 22 -	Fearnsides Yard - - -	—	—	—	—	—			372, **437**	
232. " 23 -	Peel Street - - - -	41	1	2	1	1				376
233. " 24 -	Alma Terrace - - -	5		3	1	1				378
234. " 24 -	Jacob Street - - -	93		2	1	1		380		
235. " 25 -	Wellington Street - - -	250			4	4				379, 438
236. " 26 -	Alma Terrace - - -	6		1	3	2			381	
237. " 26 -	Queen Street - - -	121		1	2				382	
238. " 27 -	King Street, B.C. - - -	152			3	2			384, 469	
239. " 28 -	Mill Lane - - - -	229			2	1				383
240. " 28 -	Field Hill - - - -	—	—	—	—	—				385, **441**
241. " 28 -	Providence Street - - -	15			7	2			386, 488	
242. " 28 -	Jacob Street - - -	—	—	—	—	—			387, 468	
243. " 28 -	Balk Street - - - -	103		1	2	2			389	
244. " 28 -	Queen Street - - -	118		—	2	2			395	
245. " 29 -	Wilton Street - - -	228		2	1	2				388
246. " 29	High Street, B.C. - - -	154		3	5	2			**391**	
247. " 29 -	Common Road - - -	270		1		4				392
248. " 29 -	Charles Street - - -	188		1	2				394	
249. March 1 -	King Street, B.C. - - -	—	—	—	—	—		390	449	448
250. " 2 -	Brownhill Street - - -	8		2	1	1				399
251. " 2 -	Oldroyd's Buildings - -	159	1	3	3	1	**524**		407, 523	522
252. " 3 -	Chapel Street - - -	227			2	3				393
253. " 3 -	Wood Street - - -	—	—	—	—	—				398
254. " 3 -	Cemetery Road - - -	290		3	3	4				408, 453
255. " 3 -	Cobden Street - - -	18			2	4				410
256. " 4 -	Small-pox Hospital - -	—	—	—	—	—			403	
257. " 4 -	Queen Street - - -	119		1	2	2		405		
258. " 4 -	Dark Lane - - - -	67			2	2			406	
259. " 5 -	King Street, B.C. - - -	153	1	2	2	2			412	
260. " 5 -	Alma Terrace - - -	63			2				415	
261. " 6 -	Queen Street - - -	169			1	1			411	462
262. " 6 -	Bk. Henrietta Street - -	—	—	—	—	—			413	
263. " 6 -	Sheard's Yard - - -	235		2	2	2				417
264. " 7 -	New Street - - -	80			1	1			418	
265. " 8 -	Ambler Street - - -	100			3	1			414, 450, 451.	
266. " 8 -	North Street - - -	—	—	—	—	—			419	
267. " 9 -	Bath Street - - -	101	1	3	5	2			416	
268. " 9 -	Track Quarry - - -	—	—	—	—	—				**420**
269. " 10 -	Wellington Street - - -	249	1	4	4	2				431
270. " 10 -	Bond Street - - -	255			2	2				435, 465
271 " 10 -	Dale Street, B.C. - - -	150		2	2			471, 472	439	
272. " 11 -	Peel Street - - - -	53			4	1			421	
273 " 11 -	Russell Street - - -	44	1	4		1		446		424
274. " 11 -	Suffolk Street - - -	145		2	1	2				**426**
275. " 11 -	North Street - - -	108			3	2			**430**	
276. " 11 -	East Street - - - -	83	1	2	1	2	**478**	**433**		
277. " 12 -	Back Hume Street - -	—	—	—	—	—				425, **427**

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* This date refers to the "date of onset" of the first case occurring in the house.

† The figures refer to the Case Register.

Small-pox at Batley, 1891-2.

List of Houses Invaded by Small-pox, &c.—*continued.*

*Date of Invasion of Small-pox.	Name of Street or Court.	Reference to House Register.	Inmates of House.				Cases of Small-pox.†			
			Under 1 year.	1 to 10.	10 to 30.	30 and upwards.	Under 1 year.	1 to 10.	10 to 30.	30 and upwards.
278. March 12 -	Holland Street - - -	261		1	1	2			429	
279. „ 13 -	Well Lane - - - -	284			1	2			436	
280. „ 14 -	Cross Bank - - -	—	—	—	—	—		432		
281. „ 14 -	Taylor Street - - -	—	—	—	—	—			434	
282. „ 15 -	Kent Street - - -	174	1	1		2				440
283. „ 15 -	Kent Street - - -	176			2				442, 443	
284. „ 17 -	New Street - - - -	—	—	—	—	—			444, **461**	
285. „ 19 -	Cobden Street - - -	24				2				454
286. „ 20 -	Cobden Street - - -	26		3	1	2			**447**	
287. „ 23 -	Crescent Street - - -	114	1	3	2	2		456		
288. „ 23 -	Peel Street - - - -	55		2	3	1			457	
289. „ 24 -	Cobden Street - - -	35		1	2				459	
290. „ 24 -	Balk Street - - - -	104			4	2			466	
291. „ 25 -	Cobden Street - - -	276		1	2				463	
292. „ 26 -	Cross Bank Street - -	274		2	1	1			490	464
293. „ 28 -	Newsome's Buildings - -	181		1	2	1			467	
294. „ 28 -	Cobden Street - - -	16		1	4	1			474	
295. „ 29 -	New Street - - - -	139	1		4	2			470	
296. „ 30 -	Suffolk Street - - -	72			2	2			473	
297. April 1 -	Clerk Green - - -	64		3		2				476
298. „ 1 -	Providence Street - - -	275			2	Age? 4			477, 526	
299. „ 2 -	Balk Street - - -	—	—	—	—	—			475	
300. „ 2 -	Richmond Street - - -	110		2	4	2 Age? 1				480
301. „ 3 -	Back Beaumont Street - -	265	1	2	3				479	
302. „ 3 -	East Street - - - -	84				3				481
303. „ 4 -	Bath Street - - - -	263				3				482
304. „ 10 -	Dale Street, B.C. - - -	151		2	1	2		485, **533**		
305. „ 10 -	Back Hume Street - -	279			3				486	
306. „ 10 -	Providence Street - - -	—	—	—	—	—				487
307. „ 11 -	Back Richmond Street - -	109	1		2				489	
308. „ 12 -	Brown's Buildings - -	178		1	3	2			491	
309. „ 17 -	Bradford Road - - -	—	—	—	—	—			492	
310. „ 18 -	Wetherall Street - - -	287	1	1	2				493	
311. „ 20 -	Dale Street, B.C. - - -	115			1	2			500	
312. „ 21 -	Taylor Street, B.C. - -	166		1	3	2		**496**	494, 497, 498.	495
313. „ 21 -	Taylor Street - - -	147			1	1			503	499
314. „ 21 -	Talbot Street - - -	171	1	1		2	**501**			
315. „ 22 -	Providence Street - - -	—	—	—	—	—				502
316. „ 25 -	Albion Street - - -	—	—	—	—	—			483	
317. „ 29 -	Kent Street - - -	297	1	3		2	527			541
318. „ 29 -	Taylor Street - - -	300		4	2			528, **547**	537	
319. „ 30 -	Bayldon's Place - - -	—	—	—	—	—			529	
320. May 1 -	Belvedere Road - - -	295		1	5	1		**544**	530	
321. „ 3 -	Back Upton Street - -	298		1	7	2			532, 539, 540.	
322. „ 6 -	Riding Street - - -	294			3	2			536	
323. „ 8 -	Ambler Street - - -	—	—	—	—	—			534	
324. „ 8 -	New Street - - - -	299		2	4	3		545	535, 543	**542**
325. „ 11 -	Purlwell Lane - - -	296				1				538
326. „ 30 -	Chapel Fold - - -	293	1	1	1		546			
327. July 16 -	Chapel Fold - - -	301		2	2	2		550	552, 553	548, 551
328. „ 22 -	Bradford Road - - -	—	—	—	—	—				**549**
267 houses visited - - - - - - -			45	312	662	428 Age? 9	17	67	279	102
60 houses not visited - - - - - -			—	—	—	—	2	12	39	26
Small-pox Hospital - - - - - -			—	—	—	—	—	—	1	
							19	79	319	128

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* This date refers to the "date of onset" of the first case occurring in the house.

† The figures refer to the Case Register

Small-pox at Batley, 1891-2.

From this it appears that 327 houses had cases of small-pox within them and the numbers invaded in each month were as follows :—

Table XXXV.

Number of cases in invaded households.

—	No. of Houses Invaded.	Number of Cases of Small-pox *per* House. 1.	2.	3.	4.	5.	6.	Proportion of Houses in which more than one Case occurred.
1891.								Per cent.
April - -	1	1	—	—	—	—	—	—
May - -	3	2	1	—	—	—	—	33·3
June - -	7	6	—	1	—	—	—	14·2
July - ..	2	1	1	—	—	—	—	50·
August - -	2	1	—	—	1	—	—	50·
September -	1	—	1	—	—	—	—	100·
October - -	—	—	—	—	—	—	—	—
November -	5	—	3	—	2	—	—	100·
December -	50	27	10	5	5	2	1	46·
1892.								
January - -	108	60	25	12	7	3	1	44·4
February - -	69	47	19	1	2	—	—	31·8
March - -	47	34	9	3	1	—	—	27·6
April - -	23	17	4	1	—	1	—	26·
May - -	7	4	1	1	1	—	—	42·8
June - -	—	—	—	—	—	—	—	—
July - -	2	1	—	—	—	1	—	50·
	327	201	74	24	19	7	2	38·57
Small-pox hospital. (March.) -		1						
Total cases -		202	148	72	76	35	12	545

Weekly incidence of cases of small-pox.—The rise and progress of the epidemic is well shown in the weekly returns. As far as possible the list has been compiled according to the *date of outset of symptoms* in each case, a plan which has been followed throughout. This does not of course tally with the dates of notification, but is an attempt to make the record more accurate. Notification in some instances is not made until some days have elapsed at the earliest on the day at which a definite rash appears; whilst occasionally a mild case has been overlooked (no medical man being called in) and its notification not made until the occurrence of another case, perhaps a fortnight later, in the house.

Weekly incidence.

The facts given in this table are graphically shown in Chart V.*

Table XXXVI.

Week of Outbreak.	Ending	No. of Cases.	Deaths.*
i.	1891. May 2 - - -	1	—
ii.	„ 9 - - -	1	—
iii.	„ 16 - - -	1	1
iv.	„ 23 - - -	1	1
v.	„ 30 - - -	1	—
vi.	June 6 - - -	No cases.	
vii.	„ 13 - - -	7	2
viii.	„ 20 - - -	No cases.	
ix.	„ 27 - - -	„	
x.	July 4 - - -	2	1
xi.	„ 11 - - -	No cases.	
xii.	„ 18 - - -	„	
xiii.	„ 25 - - -	1	—
xiv.	August 1 - - -	1	—
xv.	„ 8 - - -	1	—
xvi.	„ 15 - - -	2	—
xvii.	„ 22 - - -	2	—
xviii.	„ 29 - - -	No cases.	
xix.	September 5 - -	„	—
xx.	„ 12 - -	1	—
xxi.	„ 19 - -	1	—
xxii.	„ 26 - -	No cases.	
xxiii.	October 3 - - -	„	—
xxiv.	„ 10 - - -	„	—
xxv.	„ 17 - - -	„	—
xxvi.	„ 24 - - -	„	—
xxvii.	„ 31 - - -	„	—
xxviii.	November 7 - -	„	—
xxix.	„ 14 - -	„	—
xxx.	„ 21 - -	4	3
xxxi.	„ 28 - -	1	1
xxxii.	December 5 - -	6	—
xxxiii.	„ 12 - -	27	3
xxxiv.	„ 19 - -	15	3
xxxv.	„ 26 - -	11	—
xxxvi.	1892. January 2 - - -	34	3
xxxvii.	„ 9 - - -	29	1
xxxviii.	„ 16 - - -	34	4
xxxix.	„ 23 - - -	41	2
xl.	„ 30 - - -	53	1
xli.	February 6 - -	31	3
xlii.	„ 13 - -	22	2
xliii.	„ 20 - -	35	5
xliv.	„ 27 - -	26	1
xlv.	March 5 - - -	30	2
xlvi.	„ 12 - - -	23	5
xlvii.	„ 19 - - -	15	2
xlviii.	„ 26 - - -	17	2
xlix.	April 2 - - -	14	1
l.	„ 9 - - -	6	1
li.	„ 16 - - -	7	—
lii.	„ 23 - - -	11	2
liii.	„ 30 - - -	6	—
liv.	May 7 - - -	5	
lv.	„ 14 - - -	4	—
lvi.	„ 21 - - -	6	2
lvii.	„ 28 - - -	No cases.	

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* *Explanation of Chart V.* :—
In this Chart the weekly distribution of cases of small-pox, given for the whole Union in Charts I. and II. is shown (together with fatal cases) for each of the three divisions into which this report is divided, viz. :—

———	*Cases.*	*Deaths.*
Batley - - - - -	*545*	*57*
Dewsbury - - - -	*265*	*29**
Other districts - - - -	*219*	*14*

* *Inclusive of workhouse cases.*

* This column refers to the deaths amongst the cases attacked in the week.

Chart V.

WEEKLY PREVALENCE OF CASES IN THE SEVERAL DISTRICTS.

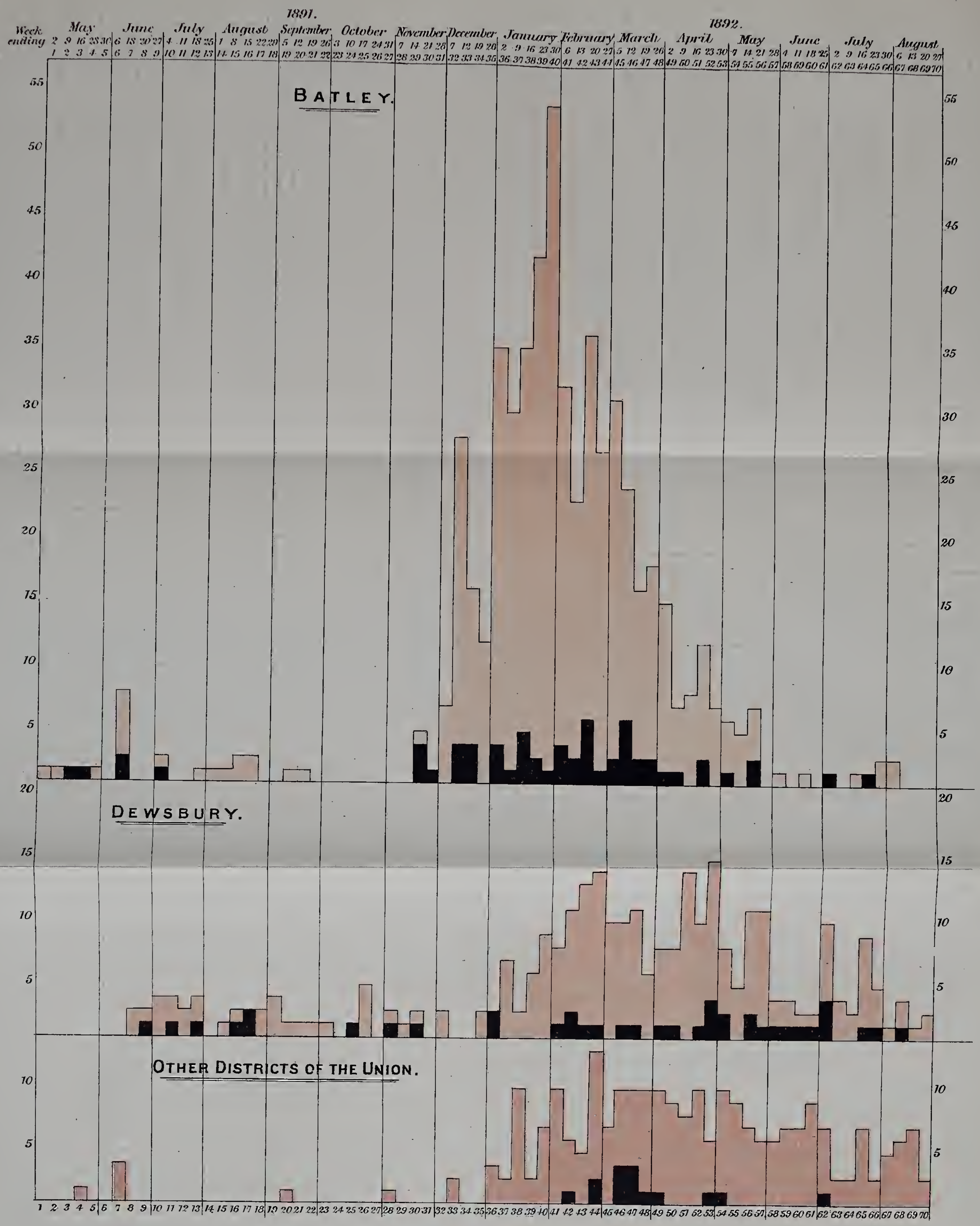

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TABLE XXXVI.—*continued.*

Week of Outbreak.	Ending	No. of Cases.	Deaths.*
lviii.	June 4	1	—
lix.	„ 11	No cases.	
lx.	„ 18	1	—
lxi.	„ 25	No cases.	
lxii.	July 2	1	1
lxiii.	„ 9	No cases.	
xiv.	„ 16	1	—
lxv.	„ 23	1	1
lxvi.	„ 30	2	—
lxvii.	August 6	2	—
lxviii.	„ 13	No cases.	
lxix.	„ 20	„	
lxx.	„ 27	„	
		545 cases.	57 deaths.

* This column refers to the deaths amongst the cases attacked in the week.

The monthly prevalence was as follows :—

——	Cases.	Deaths.
1891.		
April	1	0
May	4	2
June	8	3
July	3	0
August	5	0
September	2	0
October	0	0
November	5	4
December	76	8
1892.		
January	176	9
February	123	12
March	83	10
April	35	4
May	16	3
June	1	0
July	5	2
August	2	0
	545	57

Of the 545 individuals attacked with small-pox 269 were males, 276 females; the fatal attacks among the former amounting to 29, and among the latter to 28.

These were distributed according to their ages as follows:—

TABLE XXXVII.

——	Males.		Females.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	7	4	12	9	19	13
1 to 5 years	18	6	21	6	39	12
5 to 10 „	16	3	24	2	40	5
10 to 15 „	26	1	29	1	55	2
15 to 20 „	55	3	50	4	105	7
20 to 30 „	74	5	85	4	159	9
30 to 40 „	47	3	31	2	78	5
40 to 50 „	15	2	10	—	25	2
50 to 60 „	8	2	10	—	18	2
60 to 70 „	1	—	3	—	4	—
70 and over	2	—	1	—	3	—
	269	29	276	28	545	57

Small-pox at Batley, 1891–2.

or stated in age periods :—

——	Cases.	Deaths.	Case Mortality.
			Per cent.
Under 1 year	19	13	68·4
1 to 10 years	79	17	21·5
10 to 30 „	319	18	5·6
30 and over	128	9	7·0

in other words, the lowest mortality was between the ages of 10 and 30 years; that at 30 years and over being about one-third higher, that from 1 to 10 years about four times, and under one year 12 times as much.

One of the patients was a nurse employed at the hospital who contracted the disease, apparently by inoculation, in discharge of her duties (No. 403).

The remaining 544 cases came from 327 houses, in 201 of which there was but one case per house, in 74 there were two cases, in 24 three cases, in 19 four cases, in seven five cases and in two there were six cases.

Personal inquiry of invaded households.

Particulars of the inmates of 267 houses, yielding 465 cases, were obtained on personal inquiry, the total number of inmates being 1,456.

Of those houses which were not visited or of whose inmates no particulars could be obtained, in

42 there was 1 case per house or 42 cases in all.
17 „ were 2 cases „ „ 34 „
1 „ „ 3 „ „ „ 3 „
60 79

The distribution of the cases in proportion to the size of those houses that were visited was as follows :—

TABLE XXXVIII.

Number of Houses.	No. of Inmates to each House.	Number of Cases.						Inmates.	Cases.
		1.	3.	3.	4.	5.	6.		
5	11	3	—	1	—	1	—	55	11
10	10	2	2	2	1	1	2	100	33
15	9	7	3	1	4	—	—	135	32
20	8	9	6	1	3	1	—	160	·41
20	7	7	6	6	1	—	—	140	41
48	6	29	8	3	5	3	—	288	89
51	5	34	7	4	5	1	—	255	85
50	4	31	14	5	—	—	—	200	74
28	3	23	5	—	—	—	—	84	33
19	2	13	6	—	—	—	—	38	25
1	1	1	—	—	—	—	—	1	1
267		159	57	23	19	7	2	1,456	465

Thus there were—

No. of Members of Households.	Single Cases in House.	Multiple Cases in House.
	Per cent.	Per cent.
11	60·	40·
10	20·	80·
9	46·6	53·3
8	45·	55·
7	35·	65·
6	60·4	39·6
5	66·6	33·3
4	62·	38·
3	82·	18·
2	68·4	31·6

Small-pox at Batley, 1891–2.

A comparison of the ages of all the inmates of the households visited with those of them who contracted small-pox, showing at what age the liability was greatest, gives the following result :—

Comparison of inmates and of those attacked with small-pox.

—	Inmates.	Cases.	Proportion of Cases at Age Periods.
Under 1 year - -	45	17	Per cent. 37·7 under 1 year.
1 to 5 years - -	144	34	—
5 to 10 - -	168	33	—
	312	67	21·8 at 1 to 10 years.
10 to 15 „ - -	180	51	—
15 to 20 „ - -	206	96	—
20 to 30 „ - -	276	132	—
	662	279	41·9 at 10 to 30 years.
30 to 40 „ - -	177	64	—
40 to 50 „ - -	132	18	—
50 to 60 „ - -	80	14	—
60 to 70 „ - -	28	4	—
7 and over - -	11	2	—
	428	102	23·8 at 30 years and over.
Age not ascertained -	9	—	—

Stated in per-centages of the total numbers the comparison between those who from dwelling in the same house were exposed to the chances of infection and those who were actually attacked at the different age periods :—

—	Inmates (1,456).	Cases (465).
	Per cent.	Per cent.
Under 1 year - -	3·	3·6
1 to 10 years - -	21·4	14·4
10 to 30 „ - -	45·4	58·9
30 years and over - -	29·3	21·9

Occupations of those attacked.

Occupation Tables.—In attempting to determine whether the incidence of small-pox was to any extent influenced by the occupations of those exposed to infection, the whole community has been divided into three groups, viz. :—

(*a.*) Those engaged in domestic duties, or whose place of business was at their own homes, or who were either too young or too old to be attending school or a work-place away from home. This group contains necessarily a large proportion of married women and very young children.

(*b.*) Those who attended elementary schools during the day.

(*c.*) Those engaged in mills or in mines, or in other occupations requiring their absence from home.

The order in which these several classes were attacked is shown in Chart VI.*

The first of the tables bearing on this subject gives the occupations of those who were attacked with small-pox, with as much detail (as to sex, age and nature of employment) as was possible.

The second and third tables enumerate all the houses with the number of their inmates, classified under the three divisions above mentioned. It will be observed that the houses are grouped according to the numbers of their inmates. This table is graphically represented in Chart VII.*

TABLE XXXIX.

OCCUPATION TABLE.—MALES.

—	Under 1 Year.	1 to 10 Years.	10 to 30 Years.	30 Years and over.	Total.
AT HOME - - -	**7**	**17**	**13**	**15**	**52**
Of no occupation - -	7	17	4		28
Baker - - - -				1	1
Butcher - - -			3	1	4
Cemetery keeper - -				1	1
Eating-house keeper -				1	1
Gardener - - -				2	2
Hairdresser - - -			1		1
Herring curer - -			1		1
Hosier - - - -				1	1
Innkeeper - -				1	1
Insurance agent - -			1	1	2
Joiner - - - -				1	1
Manufacturer - -				1	1
Medical student - -			1		1
Milkvendor - - -				1	1
Pawnbroker - - -				1	1
Plumber - - -				1	1
Shoemaker - - -			1	1	2
Shop assistant - -			1		1
AT SCHOOL - -		**17**	**16**		**33**
AT WORK - - -			**126**	**58**	**184**
Millhand - - -			40	15	55
Ragsorter - - -			1	3	4
Miner - - - -			53	10	63
Barber - - -			1		1
Brickmaker - - -			1	1	2
Brushmaker - - -			1		1
Blacksmith - - -			2		2

---

* *Explanation of Chart VI. :—*
This Chart which, like Chart V., shows the weekly incidence in each of the three divisions of the Union, here adopted, is intended to illustrate the incidence upon the different classes—arranged in the three groups of those occupied (*a*) *at home,* (*b*) *attending school,* (*c*) *employed at work,* (*d*) *inmates of Union workhouse. The shades of colour are the same as those employed in Chart IV. The total figures are :—*

—	*At Home.*	*At School.*	*At Work.*	*Work-house.*
Batley - -	*183*	*68*	*294*	
Dewsbury - -	*81*	*57*	*121*	*6*
Other districts -	*76*	*48*	*95*	

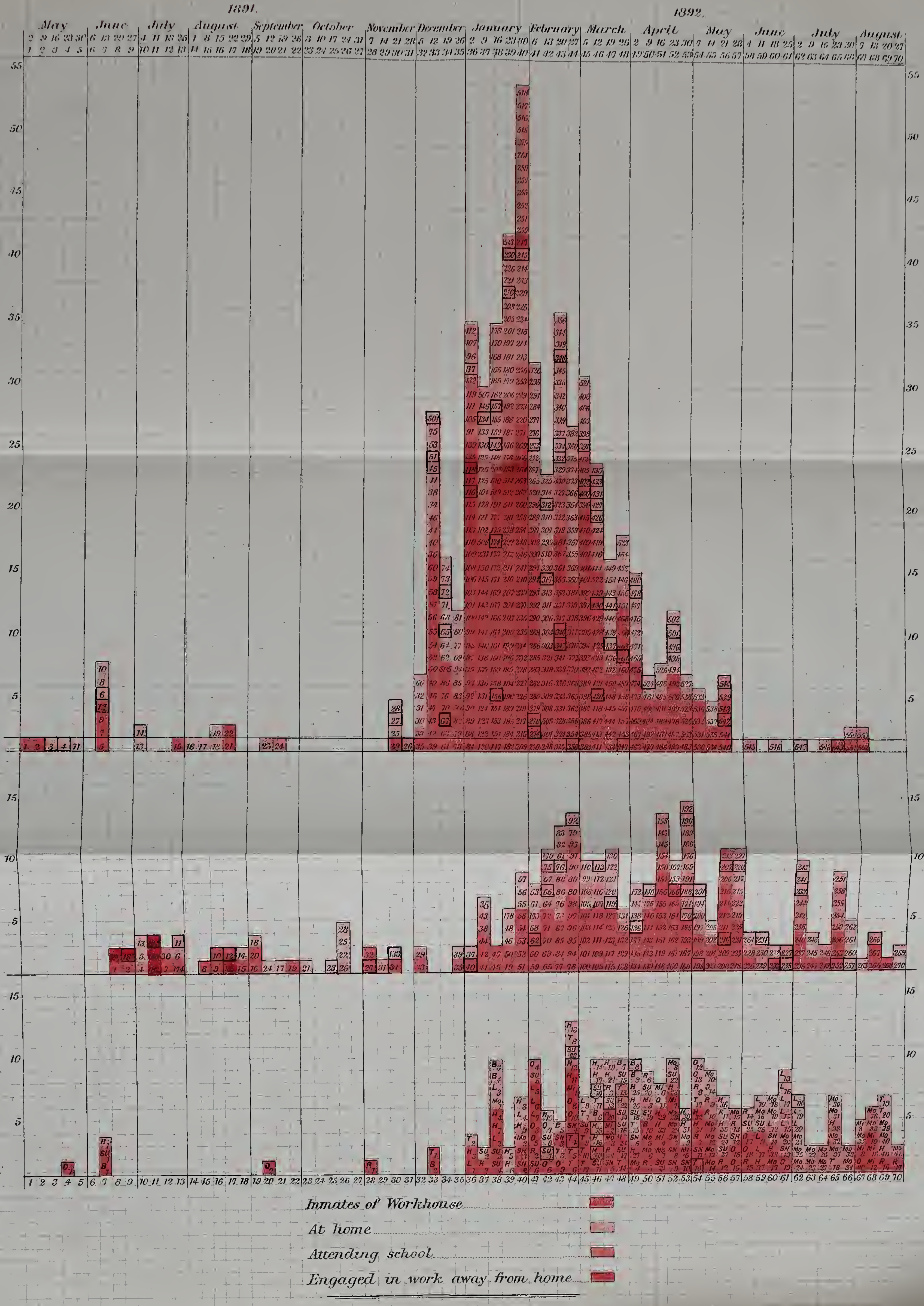
* *Explanation of Chart VII :—*
This Chart illustrates graphically the statistical facts given in Table XL., viz., the occupation of each member of the 267 infected households in Batley, of which particulars are obtained ; the members attacked with small-pox being indicated by the numbers pertaining to those in the list of cases. It will be seen that the houses are grouped according to the number of their inmates ; there being 1 house with one inmate, 19 with two inmates, 28 with three inmates, 50 with four inmates, 51 with five inmates, 48 with six inmates, 20 with seven inmates, 20 with eight inmates, 15 with nine inmates, 10 with ten inmates, and 5 with 11 inmates (*see also Table XLI.*).
The columns to the right hand of Chart indicate the cases of small-pox occurring in households of which further particulars were not obtained (*Table XLa.*).

—	*At Home.*	*At School.*	*At Work.*
1,456 inmates of 267 houses -	*573*	*271*	*612*
465 attacked with small-pox -	*162*	*58*	*245*
And in the supplementary columns :— *79 cases in 60 houses - -*	*20*	*10*	*49*
1 case arising at small-pox hospital.	*1*		

N.B.—The fatal cases are indicated by deep borders.

Chart VI.

DISTRIBUTION OF CASES ACCORDING TO OCCUPATION OF PATIENTS.



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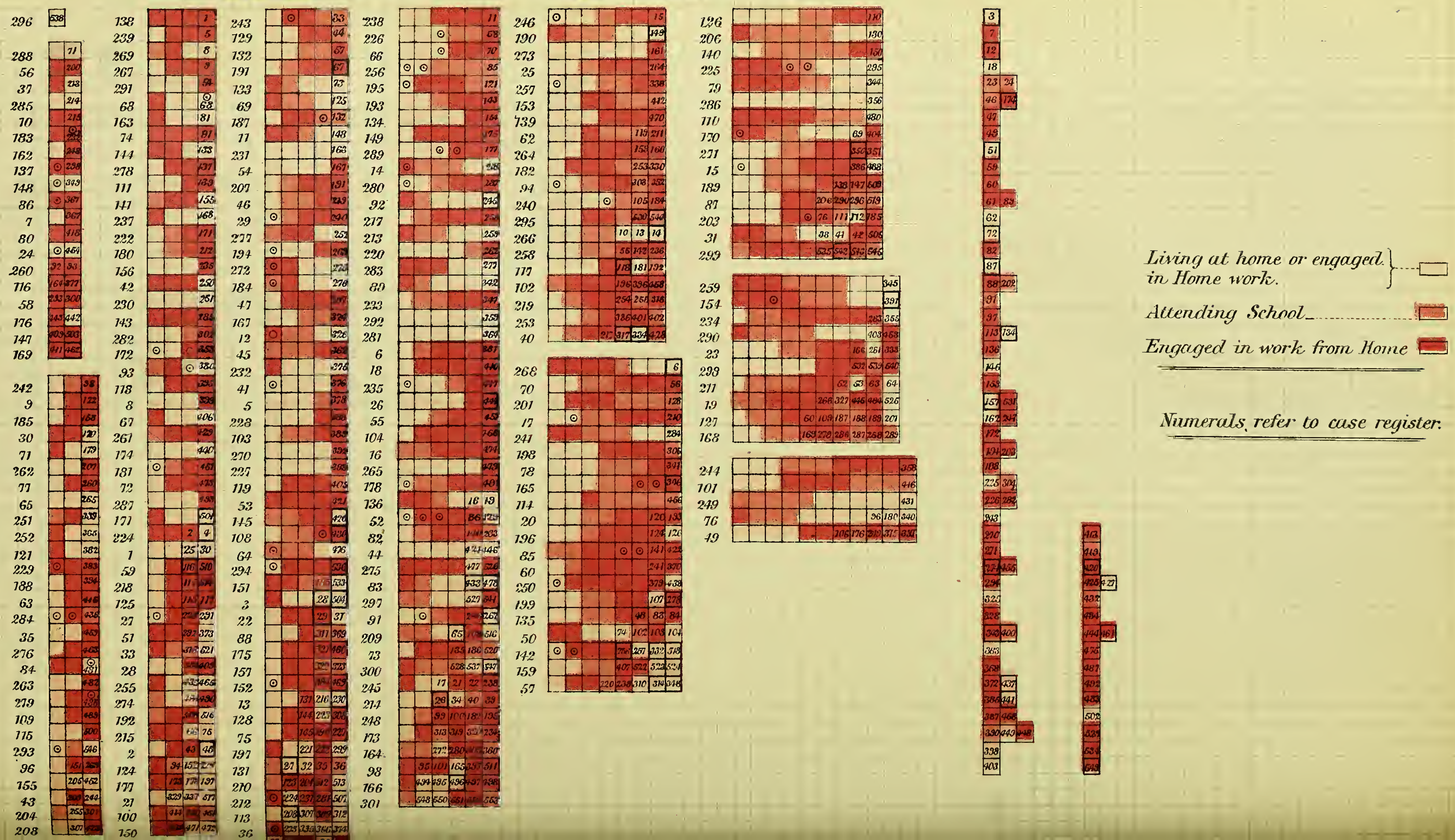
BATLEY.

Chart VII. INVADED HOUSEHOLDS, OCCUPATION OF INMATES.



Numerals refer to case register.

Small-pox at Batley, 1891-2.

OCCUPATION TABLE—*cont.*

—	Under 1 Year.	1 to 10 Years.	10 to 30 Years.	30 Years and over.	Total.
Cabdriver				1	1
Cabinetmaker				1	1
Carrier			2	2	4
Clerk			1		1
Decorator and house painter			1	1	2
Engineer			1	3	4
Errand boy			1		1
Fireman				1	1
Grocer			2		2
Hawker				1	1
Insurance agent				1	1
Joiner				2	2
Labourer			5	4	9
Librarian			1		1
Mason			1		1
Millowner			1		1
Plasterer				1	1
Plumber			2		2
Police constable			1		1
Quarryman			1		1
Rag merchant				1	1
Sanitary officer				1	1
Shoemaker				1	1
Shop assistant			1		1
Spirit merchant				1	1
Store manager			1		1
Tailor				1	1
Teamer				4	4
Turner				1	1
Warehouseman				1	1
Watchmaker			1		1
Occupation not ascertained			4		4

OCCUPATION TABLE.—FEMALES.

AT HOME	12	21	53	45	131
Of no occupation	12	21	18	1	52
Housewife			25	39	64
Domestic servant			3		3
Dressmaker			3	1	4
Grocer			1		1
Hospital nurse			1		1
Monthly nurse				1	1
Housekeeper			2	2	4
Shop assistant				1	1
AT SCHOOL		24	11		35
AT WORK			100	10	110
Millhand			66	8	74
Ragsorter			26		26
Confectioner			1		1
Dressmaker			3		3
Domestic servant				1	1
Milliner			2	1	3
Shop assistant			1		1
Occupation not ascertained.			1		1

TABLE XI.

SHOWING the OCCUPATIONS of ALL INMATES of 267 Houses visited, and of those attacked with Small-pox.

(CHART VII.)

Street or Court.	Reference in House Register.	All Inmates.			Attacked with Small-pox.		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
Purlwell Lane	296	1			538		
Heaton's Yard	288	2			71		
Peel Street	56			2			200
Hume Street	37	1		1	213		
Fox's Fold	285	2			214		
Providence Street	10			2			215
High Street	183			2			232
Sewage Works	162	1		1			248
Harrison's Fold	137			2			298
Hillbro' Road	148	2			349		
Spring Gardens	86			2			361
Brookroyd Lane	7	1		1			367
New Street	80			2			418
Cobden Street	24	2			454		
New Scarbro'	260			2			92, 93
King Street, B.C.	116			2			164, 377
Peel Street	58			2			293, 300
Kent Street	176	1		1	443		442
Taylor Street	147			2			499, 503
Queen Street	169			2			11, 462
Healey Street	242	1	1	1			98
Providence Street	9	1		2			122
Wheatcroft	185	1		2			158
Cobden Street	30	1		2	170		
Woodwell	71	2		1	179		
Bath Street	262	2		1			207
New Street	77	1		2			260
Purlwell Lane	65	3			265		
George Terrace	251	1	1	1	339		
George Terrace	252	2		1	365		
Queen Street	121	2		1	382		
Mill Lane	229			3			383
Charles Street	188	1		2			394
Alma Terrace	63	1		2			415
Well Lane	284	1	1	1		436	
Cobden Street	35	2		1			459
Cobden Street	276	1		2			463
East Street	84	1		2	481		
Bath Street	263	2		1			482
Back Hume Street	279	1		2			486
Back Richmond St.	109	1		2			489
Dale Street, B.C.	115	2		1			500
Chapel Fold	293	2	1		546		
Woodwell Street	96	1		2			269, 151
High Street, B.C.	155	3			205, 452		
Back Peel Street	43	2		1	244		209
Brearley Street	204	1	1	1	255		301
Upper North Street	208	2		1	357		423
Harrison Fold	138			4			1
Chapel Fold	239	1		3			5
Staincliffe Road	269	2	1	1	8		
Chapel Fold	267	1		3			9
Upton Street	291	3		1			54

Small-pox at Batley, 1891-9.

OCCUPATIONS of INMATES, &c.—*cont.*

Street or Court.	Reference in House Register.	All Inmates. At Home.	All Inmates. At School.	All Inmates. At Work.	Attacked with Small-pox. At Home.	Attacked with Small-pox. At School.	Attacked with Small-pox. At Work.
Clerk Green -	68	3		1	68		
Bradford Road -	163	3		1	81		
New Street - -	74			4			90
Spring Gardens -	144	2		2	133		
Hume Street -	278	1		3			137
Back Crescent St. -	111	2		2			139
New Street -	141	1		2	155		
Grosvenor Cottage	237	3		1	168		
Brearley Place -	222	1	1	2			171
Newsome Buildings	180	1	1	2			212
High Street, B.C. -	156	3		1			235
Peel Street - -	42	1		3	250		
Commercial Street	230	4			251		
New Street -	143			4			285
Wellington Street	282	2	1	1			302
Talbot Street -	172			2			353
Jacob Street -	93	2	1	1	380		
Queen Street -	118	1		3			395
Brownhill Street	8	3		1			399
Dark Lane - -	67	3		1	406		
Holland Street -	261		1	3			429
Kent Street -	174	4			440		
Newsome Buildings	181	1	1	2			467
Suffolk Street -	72	1		3			473
Wetherall Street -	287	3		1			493
Talbot Street -	171	3		1	**501**		
Pearson Street -	224	1		3	**4**		2
Dark Lane - -	1	4			25, 30		
Peel Street - -	59	1		3			**116,** 510
Colbeck Buildings	218	1		3			114, 514
Alma Terrace -	125	1		3			115, 117
Cobden Street -	27			2	291		228
Hume Street -	51	1		3	373		292
Hume Street -	33	1	2	1	521	318	
Cobden Street -	28	2		2			354, 409
Bond Street -	255	3		1	435, 465		
Cross Bank Street -	274	2	1	1	464		490
Billcliff Buildings -	192	1	1	2	515		508
Colbeck Buildings	215	2		2	66, 75		
Dark Lane - -	2	2		2	**45**		43
Alma Terrace -	124	2	1	1	152, 229	94	
Brown's Buildings	177	2		2	178, 197		173
Cobden Street -	21	4			329, 337, 517		
Ambler Street -	100		2	2		414, 451	450
Dale Street, B.C. -	150	2		2	471, 472		439
Albion Street -	243	1	2	2		33	
Dark Lane - -	129	2	1	2		44	
Dark Lane - -	132	2	2	1			57
Billcliff Buildings -	191	1	1	3			**67**
Dark Lane - -	133	3	1	1	3		
Norfolk Street -	69	2	2	1	125		
Charles Street -	187	1	2	2		132	
Providence Street -	11	2	1	2	148		
Commercial Street	231	5			163		
Peel Street - -	54	4		1			167
Upper North Street	207	1	1	3			191

OCCUPATIONS of INMATES, &c.—*cont.*

Street or Court.	Reference in House Register.	All Inmates. At Home.	All Inmates. At School.	All Inmates. At Work.	Attacked with Small-pox. At Home.	Attacked with Small-pox. At School.	Attacked with Small-pox. At Work.
Russell Street -	46	1	2	2			219
Cobden Street -	29	1	1	3			240
Bright Street -	277	2	1	2	252		
Billcliff Buildings -	194	3		2			263
Healey Lane -	272	3		2	275		
High Street -	184	3	1	1	276		
Russell Street -	47	1		4			297
Back Taylor Street	167	2	2	1			324
Providence Street -	12	2	2	1	326		
Peel Street - -	48		3	2			362
Crown Street -	232	4		1	375		
Peel Street - -	41	4		1			376
Alma Terrace -	5	3	1	1			378
Wilton Street -	228	3		2			388
Bath Street -	103	1	2	2			389
Common Road -	270	4		1			392
Chapel Street -	227	4		1			393
Queen Street -	119	1	1	3		405	
Peel Street - -	53			5			421
Suffolk Street -	145	1	2	2	**426**		
North Street -	108	1	2	2			**430**
Clerk Green -	64	2	3		476		
Riding Street -	294	1		4			536
Dale Street, B.C. -	151	1	2	2	**533**	485	
Brearley Street -	3	4		1	**28, 504**		
Hume Street -	22	2		3	31		**29**
Back Jacob Street	88	2	2	1		311, 369	
Kent Street -	175	1		4			321, 460
Albert Square, B.C.	157	1	2	2		322, 323	
King Street, B.C. -	152	1		4			384, 469
Providence Street -	13	4		1	216, **230**		131
Clerk Green -	128	2		3	223		144, 308
New Street -	75	1		4			145, 190 227
Wellington Street -	197	3		2	221, 299		222
Dark Lane - -	131	2	2	1	**27,** 32	36	35
Colbeck Buildings	210	1	1	3	513		123, 204, 512
Colbeck Buildings	212	2		3	224, 507		231, 281
Cross Bank - -	113	4		1	**208,** 307, 312		309
Hume Street -	36	4		1	273, 335, 366, 374		
Humo Street -	39	2		3	77, 80		78, 79, 506
Chapel Fold -	238	2		4			11
Honriotta Street -	226	3	2	1			58
Clerk Green -	66	3		3			70
Stanley Place -	256	2	4			85	
Billcliff Buildings -	195	1	2	3		121	
Billcliff Buildings -	193	2	1	3			148
Dark Lane - -	134	4		2			154
Dale Street, B.C. -	149	1		5			175
Wellington Street -	289	3		3			177
Providence Street -	14	2	3	1	218		
Bradford Road -	280	2	1	3			237
Jacob Street -	92	4	1	1	**245**		
Colbeck Buildings	217	1	1	4			258
Colbeck Buildings	213	3	2	1	259		
Colbeck Buildings	220	4	1	1			262
Spa Street - -	283	3		3	277		

OCCUPATIONS of INMATES, &c.—*cont.*

Street or Court.	Reference in House Register.	All Inmates.			Attacked with Small-pox.		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
Jacob Street -	89	4	1	1	342		
Ward's Hill -	233	1	2	3			347
Commercial Street	292	6			359		
Hick Lane - -	281	6			364		
Alma Terrace -	6	1	1	4			381
Cobden Street -	18	1		5			410
Sheard's Yard -	235	3	1	2			417
Cobden Street -	26	4		2			**447**
Peel Street - -	55	2	1	3			457
Balk Street -	104	1		5			466
Cobden Street -	16		2	4			474
Back Beaumont St.	265	5		1			479
Brown's Buildings	178	1	2	3			491
Clay Hill - -	136	3	1	2	16, 19		
Hume Street -	52	2		4	129		86
East Street - -	82	1	2	3		233	140
Russell Street -	44	6			424, 446		
Providence Street -	275	1		5	477		526
East Street - -	83	4	1	1	**433, 478**		
Kent Street -	297	3	2	1	527		541
Jacob Street -	91	3	1	2	**267**		246
Colbeck Buildings	209	3	2	1	**65,** 516		108
Suffolk Street -	73	1	2	3		186, 520	135
Taylor Street, B.C.	300	2	3	1	537, **547**	528	
Victoria Street, B.C.	245	2		4	17		21, 22, 238
Colbeck Buildings	214	3	2	1	34	**26,** 40	39
Oxford Street -	248	1	1	4			99, 100, 182, 195
Berkeley Fold -	173	1	2	3		313, 320	234, 319
Back Taylor Street	164	1	3	2	272	360	280, 305
Parker's Place -	98	1		5	165		95, 101, 397, 511
Taylor Street -	166	3		3	494, **496,** 495		498, 497
Chapel Fold -	301	2	2	2	550, 548	553	552, 551
Track Quarry -	246	3	1	3			15
Billcliff Buildings	190	3	3	1	**149**		
Healey Lane -	273	6		1			161
Cobden Street -	25	2	1	4			264
Bridge Street -	257	3	2	2			338
King Street, B.C. -	153	2	3	2		412	
New Street - -	139	3		4			470
Woodwell Street -	62	2	3	2		119	211
Pit Lane - -	264	2		5			159, 160
High Street -	182	1	3	3		253, 330	
Back Woodwell St.	94	2	2	3		303	352
Cullingworth St. -	240	4	2	1		105	184
Belvedere Road -	295	2	2	3		**544**	530
Chapel Fold -	266	5	2		10, 13, **14**		
Cheapside - -	258	2	2	3			55, 142, 236
King Street -	117	4	1	2	187	192	**118**
Balk Street -	102		1	6			196, 396, 458
Colbeck Buildings	219	1	2	4		256	254, 316
George Terrace -	253	2	2	3		402	336, 401
Peel Street - -	40	2	2	3	**334**	**317**	217, 428
Cullingworth St. -	268	3	1	4	**6**		
Norfolk Street -	70	2	2	4			
North Parade -	201	1	3	4		128	

OCCUPATIONS of INMATES, &c.—*cont.*

Street or Court.	Reference in House Register.	All Inmates.			Attacked with Small-pox.		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
Cobden Street -	17	2	2	4			210
Staincliffe - -	241	3	3	2	284		
Wellington Street	198	3	1	4		306	
New Street -	78	3	3	2			341
Taylor Street -	165	3	2	3			**346**
Crescent Street -	114	2	5	1		456	
Cobden Street -	20	2	2	4			120, 193
Billcliff Buildings	196	3	1	4	126		124
Spring Gardens -	85		2	6			141, 422
Jacob Street -	60	1	1	6			241, 370
Wellington Street	250	2		6	438		379
Oxford Street -	199	3	2	3	107		**278**
Clay Fold - -	135	2	3	3		83	48, 84
Hume Street -	50	4	1	3	74, 104	102	103
New Street - -	142	4		4	257, **332,** 518		**156**
Oldroyd's Buildings	159	4	2	2	523, **524**		407, 522
Peel Street - -	57	4	1	3	310, **314, 348**	220	239
Alma Terrace -	126	4	2	3			110
Belvedere Road -	206	3	5	1	130		
New Street - -	140	2	5	2			150
Fleming's Place -	225	4	2	3	295		
New Street - -	79	3	2	4	344		
Commercial Street	286	9			356		
Richmond Street -	110	1	3	5	480		
Queen Street -	170	4	2	3	69		404
Corporation Cottages.	271	3	2	4			**350,** 351
Providence Street	15	3	2	4	488		386
Charles Street -	189	2	3	4			138, 147, 509
Jacob Street -	87	3	3	3		206, 296, 519	290
North Parade -	203	4	1	4	112	111	76, 185
Hume Street -	31	3	2	4	38, 41		42, 505
New Street - -	299		2	7		545	535, **542,** 54
New Scarbro' -	259	3	4	3	345		
High Street, B.C. -	154	3	3	4	**391**		
Ward's Hill -	234	2	2	6	355		283
Cemetery Road -	290	4	4	2	408		453
Hume Street -	23	4	2	4	261		166, 333
Back Upton Street	298	5	1	4		539	532, 540
Colbeck Buildings	211	3	3	4	53, 64		52, 63
Cobden Street -	19	1	3	6	525	327	266, 445, 484
Clerk Green -	127	2	4	4	201	187, 188	109, 50, 189
Queen Street -	168	2	4	4		287, 289	169, 279, 286, 288
King Street, B.C. -	244	3	3	5			358
Bath Street -	101	3	4	4		416	
Wellington Street	249	6	5		431		
New Street -	76	7	3	1	96, 180, 340		
Hume Street -	49	4	2	5		176, 249	106, 315, 331
267 Households -		573	271	612	162		245

Small-pox at Batley, 1891–2.

TABLE XLa.

TABLE showing OCCUPATIONS of those attacked with SMALL-POX in the 60 Houses not visited.

—	At Home.	At School.	At Work.
High Street	**3**		
Cullingworth Street			7
Upper North Street			**12**
Clay Fold	18		
Back Chapel Street		23, 24	
Hume Street		46	**174**
Ward's Hill			47
Grosvenor Cottage			49
Billeliff Buildings	**51**		
Wheatcroft			59
Hanover Street			60
Crescent Street			61, 89
Dark Lan	62		
Union Street	**72**		
Hume Street			82
Brown' Buildings	**87**		
Carlinghow Lane		202	88
Grafton Street		91	
Staincliffe			97
Wetherall Street	**134**		113
Parker's Place			136
Wilton Street	146		
Harrison's Fold			153
Woodwell Street	**157**		531
Dark Lane	162		247
Wilson's Buildings			172
Charles Street			194, 203
Purlwell Lane			198
Henry Street, B. C.	225	304	
Victoria Street, B. C.			226, 282
Hick Lane	243		
Woo dwell Street			270
Warwick Mount			271
Brown's Buildings			**274**, 455
Clay Fold			294
Suffolk Street	325		
Victoria Street			328
Spa Street		**400**	**343**
Healey Lane	363		
Havercroft Fold			368
Fearnside's Yard	**437**		372
Field Hill	**441**		385
Jacob Street			387, 468
King Street, B. C.	449	390	448
Wood Street	398		
Back Henrietta Street			413
North Street		419	
Track Quarry			**420**
Back Hume Street	**427**		425
Cross Bank		432	
Taylor Street			434
New Street			444, **461**
Balk Street			475
Providence Street			487
Bradford Road			492
Albion Street			483
Providence Street	502		
Blaydon's Place			529
Ambler Street			534
Bradford Road			**549**
60 houses	20	10	49
Small-pox hospital	403		

The facts given in the preceding table (XL) and Chart VII. may be thus summarised:—

Of the 1,456 persons inhabiting 267 houses invaded by small-pox, there were,—

573 living at home and engaged in home-work.
271 attending school.
612 engaged in daily work away from home.

Of those attacked with small-pox there were :—

162 at home or 28·2 per cent.
58 at school or 21·4 per cent.
245 at work or 39·9 per cent.

The same series analysed according to the *size* of the households give :—

TABLE XLI.

Number of Inmates per House.	Number of Houses.	Total Inmates.			Total Cases.		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
11	5	23	17	15	4	3	4
10	10	29	30	41	9	6	18
9	15	48	36	51	10	5	17
8	20	51	37	72	15	6	20
7	20	51	34	55	6	11	24
6	48	118	52	118	30	12	47
5	51	108	45	102	34	10	41
4	50	91	15	94	34	4	36
3	28	41	5	38	13	1	19
2	19	12	—	26	6	—	19
1	1	1	—	—	1	—	—
	267	573	271	612	162	58	245

Taking the whole numbers of each series, it is seen that of those—

(*a.*) Engaged at home there were in all 183 cases, 35 of which were fatal, a mortality in this class of 19·2 per cent.

(*b.*) Attending school 68 cases, four of which were fatal, a mortality of 5·8 per cent.

(*c.*) Engaged in work away from home 294 cases, 18 of which were fatal, a mortality of 6·7 per cent.

The high death-rate of class (*a*) is due to the inclusion in it of all infants.

Type of disease.

Type of Attacks of Small-pox.—As regards the type of the disease amongst these 545 cases, it was found that there were :

126	confluent cases or	23·1	per cent.
75	coherent ,, ,,	13.7	,,
197	discrete ,, ,,	36·1	,,
142	mild ,, ,,	26·0	,,

and in five cases the type could not be ascertained.

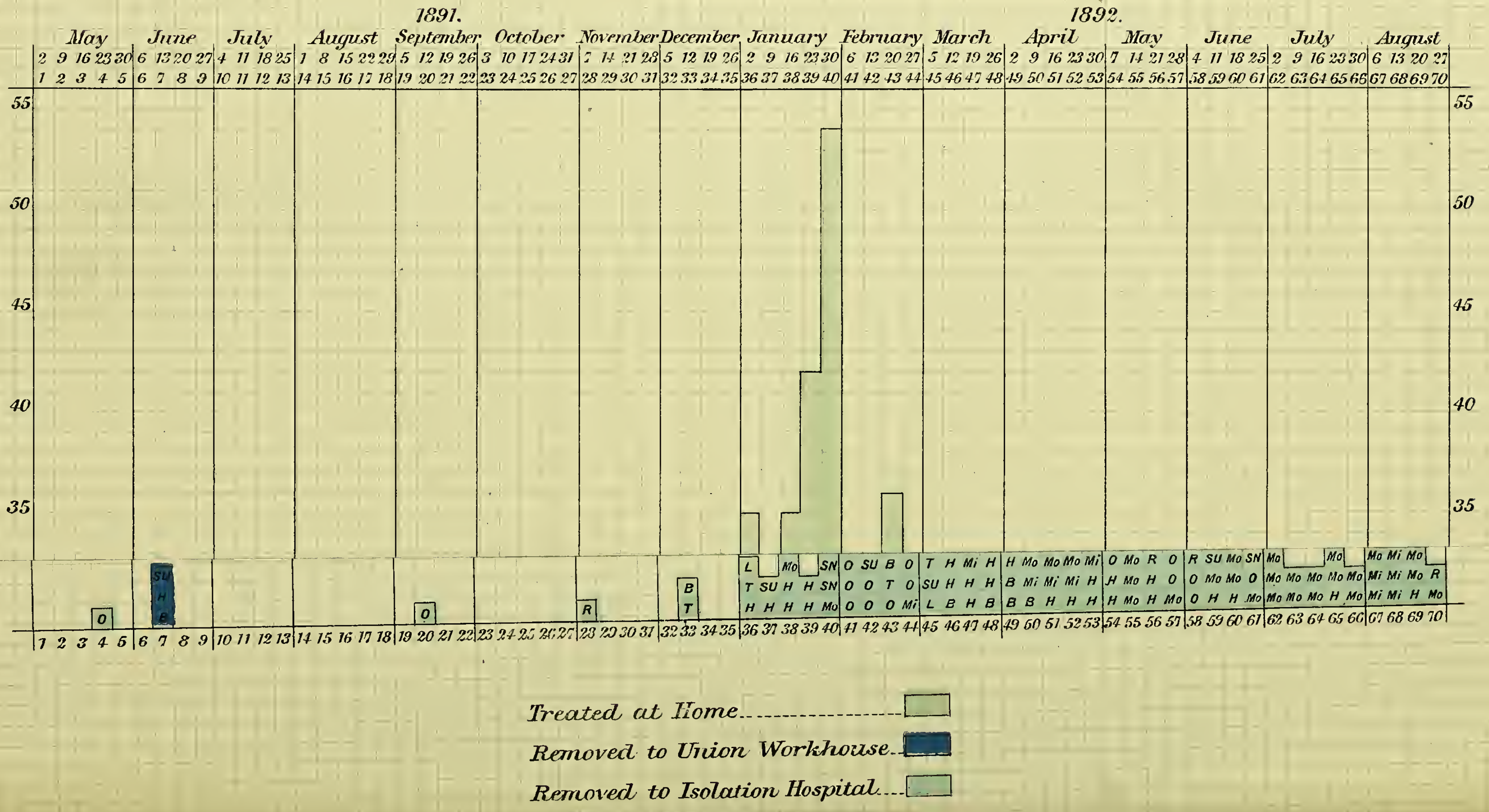
The proportion of confluent cases was therefore below that for the whole district (26·5 per cent.) *See* p. 29.

The mortality of the whole number was 10·4 per cent.; three of the 57 fatal cases being of the discrete type; the rest confluent (including two hæmorrhagic).

The average mortality of the whole district was 10·7 per cent.

Chart VIII.

DISTRIBUTION OF CASES ACCORDING TO MEASURES OF ISOLATION.



The distribution of these cases at different life periods was as follows :—

—	Cases.	Per cent.
Under 1 *year of age* - -	19	—
Confluent - - -	15	79·
Coherent - - -	1	5·2
Discrete - - -	3	15·8
From 1 *to* 10 *years* - -	79	—
Confluent - - -	24	30·
Coherent - - -	11	13·7
Discrete - - -	28	36·2
Mild - - -	14	17·5
Type not determined -	2	—
From 10 *to* 30 *years* - -	319	—
Confluent - - -	64	20·1
Coherent - - -	49	15·4
Discrete - - -	117	36·5
Mild - - -	88	27·4
Type not determined -	1	—
30 *years and upwards* - -	128	—
Confluent - - -	23	17·7
Coherent - - -	14	10·8
Discrete - -	49	38·
Mild - - -	40	31·7
Type not determined -	2	—

Isolation Measures.—More than one-half of the cases were treated in their own homes. During 1891, 26 of the total number of 87 cases were removed for treatment to the union workhouse at Staincliffe, which however was closed to non-paupers at the end of the year. During 1892 (up to August 27) there had been removed to the small-pox hospital, erected by the Batley Corporation, and opened on January 1st, 217 cases; 241 being retained at home.

In the case of those kept at home endeavours were made by the authorities to restrain the movements of the remaining inmates of the infected houses, but with only partial success. In some instances all the members of the household were kept in the house until it had been disinfected, a matter of three to six weeks, or even longer, according to the severity of the case.

From the annexed tables, and Chart VIII. it will be seen that it was not until the 43rd week of the epidemic that more patients were removed of those attacked in the week than were kept at home; whilst from the 54th week onwards every patient was thus removed.

TABLE XLII.

MEASURES OF ISOLATION. MONTHLY DISTRIBUTION.

Cases arising in	Sent to Workhouse.		Sent to Small-pox Hospital.		Remained at Home.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1891.						
April - - -	1	—	—	—	—	—
May - - - -	2	1	—	—	2	1
June - - -	5	3	—	—	3	—
July - - - -	1	—	—	—	2	—
August - - -	—	—	—	—	5	—
September - - -	—	—	—	—	2	—
October - - -	—	—	—	—	—	—
November - - -	—	—	—	—	5	4
December - - -	17	2	3	—	56	6
1892.						
January - - -	—	—	41	1	135	8
February - - -	—	—	52	5	71	7
March - - -	—	—	72	8	11	2
April - - -	—	—	26	2	9	2
May - - -	—	—	15	3	1	—
June - - -	—	—	1	—	—	—
July - - -	—	—	5	2	—	—
August - - -	—	—	2	—	—	—
	26	6	217	21	302	30

Thus of those sent to the workhouse infirmary the mortality was 23 per cent.; of those sent to the small-pox hospital it was 9·6 per cent.; and of those treated in their homes it was 9·9 per cent.

Small-pox at Batley, 1891–2.

TABLE XLIII.

MEASURES OF ISOLATION. IN WEEKS OF EPIDEMIC.

(Chart VIII.)*

1891.

Week of Epidemic.	Sent to Union Workhouse Infirmary.		Treated at Home.	
	Cases.	Deaths.	Cases.	Deaths.
i.	1	—	—	—
ii.	1	—	—	—
iii	—	—	1	1
iv.	1	1	—	—
v.	—	—	1	—
vii.	4	2	3	—
x.	2	1	—	—
xiii.	—	—	1	—
xiv.	—	—	1	—
xv.	—	—	1	—
xvi.	—	—	2	—
xvii.	—	—	2	—
xx.	—	—	1	—
xxi.	—	—	1	—
xxx.	—	—	4	3
xxxi.	—	—	1	1
xxxii.	3	—	3	—
xxxiii.	9	2	18	1
xxxiv.	1	—	14	3
xxxv.	4	—	7	—
	26	6	61	9

1892.

Week of Epidemic.	Sent to Small-pox Hospital.		Treated at Home.	
	Cases.	Deaths.	Cases.	Deaths
xxxvi.	7	1	27	2
xxxvii.	7	—	22	1
xxxviii.	9	—	25	4
xxxix.	11	—	30	2
xl.	10	—	43	1
xli.	5	1	26	2
xlii.	1	—	21	2
xliii.	23	2	12	3
xliv.	16	1	10	—
xlv.	22	1	8	1

* *Explanation of Chart VIII.:—*
This chart, drawn on the same plan as Chart V. and VI., illustrates the measures of isolation of the cases of small-pox adopted in each of the infected districts, in each week of the outbreak. The different shades of tint indicate the cases: (a) *retained at home;* (b) *removed to special hospital;* (c) *to the workhouse infirmary.*
The figures upon which the chart is based are to be found in Table XLIII., and in the text of report on Dewsbury and other Districts.
The chart shows that there were :—

—	*At Home.*	*Hospital*	*Workhouse.*
Batley - - - -	*302*	*17*	*6*
Dewsbury - - -	*5*	*254*	*6 (inmates)*
Other districts - -	*48*	*168*	*3*

Small-pox at Batley, 1891-2.

1892—*continued.*

Week of epidemic.	Sent to Small-pox Hospital.		Treated at Home.	
	Cases.	Deaths.	Cases.	Deaths.
xlvi.	21	4	2	1
xlvii.	13	2	2	—
xlviii.	15	2	2	—
xlix.	10	—	4	1
l.	4	—	2	1
li.	6	—	1	—
lii.	10	2	1	—
liii.	4	—	2	—
liv.	4	1	1	—
lv.	4	—	—	—
lvi.	6	2	—	—
lviii.	1	—	—	—
lx.	1	—	—	—
lxii.	1	1	—	—
lxiv.	1	—	—	—
lxv.	1	1	—	—
lxvi.	2	—	—	—
lxvii.	2	—	—	—
	217	21	241	21

The distribution of these cases with respect to age and sex was as follows :—

Table XLIV.

—	Sent to								Remained at Home.			
	Workhouse.				Hospital.							
	Male.		Female.		Male.		Female.		Male.		Female.	
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.
Under 1 year -	—	—	1	1	1	—	2	1	6	4	9	7
1 to 5 years -	1	—	5	2	7	1	5	2	10	5	11	2
5 to 10 „ -	—	—	1	—	7	1	9	—	9	2	14	2
10 to 15 „ -	—	—	—	—	6	—	10	—	20	1	19	1
15 to 20 „ -	1	—	3	1	25	2	19	2	29	1	29	1
20 to 30 „ -	3	—	5	1	37	3	34	2	34	2	45	1
30 to 40 „ -	2	—	2	—	24	2	15	2	21	1	15	—
40 to 50 „ -	1	1	—	—	6	1	2	—	8	—	7	—
50 to 60 „ -	—	—	1	—	2	2	4	—	6	—	5	—
60 to 70 „ -	—	—	—	—	1	—	—	—	—	—	3	—
70 and over -	—	—	—	—	—	—	1	—	2	—	—	—
	8	1	18	5	116	12	101	9	145	16	157	14

Analysing these returns still further, in reference to the number of cases occurring in a house, we find that of the 202 "single" cases (proceeding from 201 houses and the small-pox hospital),—

There were treated at home	- - -	96
„ „	workhouse infirmary	6
„ „	small-pox hospital -	100

Whereas of the 343 "multiple" cases in 126 houses,—

There were treated at home	- - -	206
„ „	workhouse infirmary	20
„ „	small-pox hospital -	117

This second group may be subdivided according to the number of cases arising in the household. Thus :—

(A.)

Of 74 *households in which two cases occurred :—*

In 34, both cases were treated at home through the whole illness.
„ 19, one case remained at home, the other was removed to hospital (17) or infirmary (2).
„ 21, both were sent to hospital (20) or infirmary (1).

(B.)

Of 24 *households in which three cases occurred :—*

In 10, all remained at home.
„ 2, two remained at home, one was sent to hospital
„ 3, one remained at home, and two were sent to hospital (2) or infirmary (1).
„ 9, all were sent to hospital.

(C.)

Of 19 *households in which four cases occurred :—*

In 12, all remained at home.
„ 1, three remained at home, one sent to hospital.
„ 4, one remained at home, three sent to hospital (2) or infirmary (2).
„ 2, all were removed to the infirmary (1) or hospital.

(D.)

Of seven households in which five cases occurred :—

In 1, all remained at home.
„ 1, four remained at home, one sent to hospital.
„ 2, one remained at home, four sent or hospital (1) or to infirmary (1).
„ 3, all removed to hospital.

(E.)

Of two households in which six cases occurred :—

In both all the patients remained at home.

This may be summarised as follows :—

Cases of Small-pox in Households.

—		One Case.	Two Cases.	Three Cases.	Four Cases.	Five Cases.	Six Cases.
Number of Houses -		202	74	24	19	7	2
All remained at home - -		96	70	33	48	5	12
Part at home.	At home - - -	—	19	5	8	6	—
	Sent to workhouse infirmary.	—	2	2	6	4	—
	Sent to small-pox hospital	—	17	5	10	5	—
All sent to workhouse infirmary,		6	2	—	4	—	—
All sent to small-pox hospital		100	38	27	—	15	—
		202	148	72	76	35	12

It might be supposed *à priori* that the risks of infection of other members of the family were much greater in those cases where the patient was detained at home—generally in a small crowded tenement—than where he was removed to hospital; but on examination of this group of "multiple cases in households" there is no very striking difference between the two series, as will appear from the following figures based on 108 of these households of which the number of members was obtained.

These 108 houses comprise :—

Houses.	Inmates.	Total.	No. attacked with Small-pox.
2	11	22	8
8	10	80	31
8	9	72	25
11	8	88	32
13	7	91	34
19	6	114	60
17	5	85	51
19	4	76	43
5	3	15	10
6	2	12	12
108	——	655	306

giving an "attack-rate" of 2·1 : 1 or 46·8 per cent.

Now in 52 of these households, numbering 303 members in all, *every case was treated at home,* viz., 150, an attack-rate for this category of 2 : 1 or 50 per cent.

In 26 of these households, numbering 162 members, the cases of small-pox were *in part treated at home, in part sent to the workhouse infirmary or hospital;* they number 75, giving an attack-rate of 2 · 1 : 1 or 46 · 3 per cent.

In 30 of these households, numbering 190 members, the cases were *all sent to infirmary or hospital,* viz., 81, an attack-rate of 2 · 3 : 1 or 42 · 6 per cent.

This comparatively small, though appreciable, testimony to the value of hospital isolation is however increased by the fact that the average number of inmates of the house, and therefore of those presumably exposed to infection from the case was lowest in the series which yielded the largest proportion of cases. In the 52 houses where the patients were nursed wholly at home, the average number of inmates was 5 · 8; in the 26 houses where one or more of the patients were removed, the rest being kept at home, the average number of inmates was 6 · 2; and in the 30 houses, where all the cases were removed, the average number of inmates was 6 · 3. It will be seen that this proportionate rise in the numbers exposed to infection is inverse to the proportionate rise in the attack-rates of the three series.

It would, however, be unfair to estimate the value of hospital isolation in small-pox on these figures alone, for they require to be checked by many other considerations, such as the time of removal after development of symptoms, the dates at which the other patients were attacked, and the possible influence of vaccination upon those exposed to infection. The latter question does not come much into play in these returns, as comparatively little re-vaccination was done; but such as it was will be dealt with in the next part of the report (p. 130).

I propose, however, to attempt to deal with some of the other facts, so far as they are capable of analysis. Before doing so it may be useful to state that of the whole number of 545 patients, 265 were of the class in which no case was removed from the infected house; 85 belong to that class in which some were removed and some were not; and 195 to the class where every case in the house was removed.

Small-pox at Batley, 1891–2.

It has been previously stated that the cases of small-pox came from 327 houses and one from the small-pox hospital, that 201 houses yielded each a single case; whilst multiple (*i.e.*, two or more) cases came from 126 houses.

Single and multiple cases in households.

Of the first group, 97 were treated at home.

" " 104 were removed to the workhouse infirmary or the small-pox hospital (to which may be added the case arising there).

Of the second group, 168 coming from 61 houses were treated at home; 90 coming from 34 houses were removed to hospital or infirmary; whilst of the remaining 85 from 31 houses, some (in each case) remained, and some were removed.

Single Cases in Houses.

In 159 houses that were inspected, containing a total of 801, or an average of five inmates per house, there was only a single case of small-pox. In 77 the patients were treated at home, the total number of dwellers being 387, or an average of five per house, and the attack-rate was 5 : 1 or 20 per cent. In 82, the patient was removed to workhouse or hospital, the total number of dwellers being 414, or an average of five per house, the attack-rate being nearly 5 : 1 or 19·7 per cent.

Multiple Cases in Houses.

The first fact, which has already been stated from another point of view is, that in the 126 households where more than one case occurred, 35 "primary" cases were removed to infirmary or hospital; and that to them there succeeded 58 subsequent cases (the majority probably infected from the first case), which gives a ratio of 1 : 1·6. On the other hand 91 "primary" cases were treated at home, and were followed by 159 subsequent cases or a ratio of 1 : 1·7, which does not seem to show any marked advantage from hospital isolation.

It may, however, be shown by grouping these cases in three series that the liability to infection was somewhat greater when no case was removed from the house. I have for this object compiled the following tables, corresponding to each Series.

Series A comprises those households, 43 in number, in which all the "initial cases," signifying by that term every person who sickened within 10 days of the first to be attacked, and most of the "later cases" arising in the same house were removed to hospital or infirmary. In the Table (XLV.) the dates of the appearance of the rash and of the removal to hospital of the initial cases are given; whilst as regards the later cases the date of the rash is stated and also the day of the illness of the first case to which it corresponds, together with the date of removal of the later case to hospital.

It will be seen that on this reckoning there were in these 43 households, 61 "initial cases," and 56 "later cases."

Series B. comprises those households, 24 in number, in which the "initial case" (or cases) was kept at home, whilst the later cases (or some of them) were removed.

The 24 households yielded 26 initial cases and 37 later cases.

Series C. comprises those households, 59 in number, in which all the cases (whether "initial" or "later") were retained at home.

The 59 households yielded 67 initial cases and 78 later cases.

TABLE XLV.

Small-pox at Batley, 1891-2.

MULTIPLE CASES in Households showing (*a*) day of Illness on which rash appeared in the First Case; (*b*) Day of Attack on which this Case was removed to Hospital; (*c*) Cases in same House occurring together with, or subsequent to the First Case, arranged in order of onset, with reference to the day of Attack of the first Case.

Series A.

House.	Number of Inmates.	Initial Case.				Later Cases.				Remarks.
		Reference to Case Register.	Date of			Reference to Case Register.	Date of Rash.	Day of Attack of First Case.	Date of Removal.	
			Rash.	Removal to Hospital.	Day of Attack when removed.					
224	4	2	May 4	May 12	10th	4	May 23	20th	May 26	
31	9	38	Dec. 7	Dec. 9	4th	505	Dec. 18	10th	Dec. 9	Sent to workhouse with rest.
		41	Dec. 7	Dec. 9	4th					
		42	Dec. 7	Dec. 9	4th					
39	5	77	Dec. 28	Dec. 31						
		78	Dec. 26	Dec. 31						
		79	Dec. 25	Dec. 31						
		80	About 26	Dec. 31						
		506	Dec. 26	Dec. 31						
240	7	105	Dec. 29	Jan. 4	9th	184	Jan. 18	24th	Jan. 21	
117	7	118	Jan. 5	Jan. 9	8th	181	Jan. 20	20th	—	Remained at home.
						192	Jan. 22	22nd	Jan. 23	
49	11	106	Jan. 3	Jan. 6	6th	176	Jan. 19	19th	Jan. 21	
						249	About Feb. 1	32nd	Feb. 17	
						315	Feb. 18	49th	Feb. 19	
						331	About Feb. 17	48th	Feb. 23	
189	9	138	Jan. 9	Jan. 12	7th	147	Jan. 12	7th	Jan. 13	Reckoned as "initial cases."
						509	Jan. 13	8th	Jan. 13	
20	8	120	Jan. 6	Jan. 6	4th	193	Jan. 21	19th	Feb. 12	
75	5	145	?	Jan. 13	5th	190	Jan. 22	14th	Jan 22.	
						227	Jan. 27	19th	—	Remained at home.
85	8	141	Jan. 10	Jan 12	5th	422	March 12		March 14	Obviously fresh infection.
264	7	159	Jan. 14	Jan. 17	6th					
		160	Jan. 16	Jan. 17	7th					
23	10	166	?	Jan. 17	3rd	261	Feb. 3	20th	—	Remained at home.
						333	About Feb. 17	34th	Feb. 18	
116	2	164	Jan. 16	Jan. 17	4th	377	Feb. 27	45th	Feb. 27	Probably fresh infection.
155	3	205	Jan. 23	Jan. 25	5th	452	March 22		March 23	Fresh infection.
43	3	209	Feb. 25	Feb. 26	3rd					
		244	Feb. 28	—	—					Remained at home.
—	—	372	Feb. 26	Feb. 26	5th	437	About Mar. 16	24th	—	Remained at home.
19	10	266	Feb. 3	Feb. 6	10th	327	Feb. 17	21st	Feb. 21	
						445	March 18	51st	March 21	
						484	April 9	73rd	April 9	
						525	April 13	77th	—	Remained at home.
51	4	292	?	Feb. 20	19th	373	Feb. 26	25th	—	Remained at home.
157	5	322	Feb. 16	Feb. 18	5th					
		323	Feb. 16	Feb. 18	5th					
—	—	343	Feb. 21	Feb. 21	4th	400	March 5	18th	—	Remained at home.

Small-pox at Batley, 1891–2.

MULTIPLE CASES in HOUSEHOLDS—*cont.*

House.	Number of Inmates.	Initial Cases.				Later Cases.				Remarks.
		Reference to Case Register.	Date of Rash.	Date of Removal to Hospital.	Date of Day of Attack when removed.	Reference to Case Register.	Date of Rash.	Day of Attack of First Case.	Date of Removal.	
253	7	336	?	Feb. 24	5th	401	March 6	16th	March 7	
						402	March 6	16th	March 7	
250	8	379	Feb. 28	March 2	7th	438	March 17	26th	March 18	
152	5	384	Feb. 29	March 1	4th	469	March 31	34th	March 31	
—	—	385	March 1	March 1	3rd	441	March 18	21st	March 18	
—	—	390	March 3	March 3	3rd	448	March 21	21st	March 22	
						449	March 21	21st	March 22	
—	—	425	March 15	March 15	4th					
		427	March 15	March 15	4th					
44	6	424	March 13	March 15	5th	446	March 21	11th	March 21	
100	4	414	March 9	March 11	4th	450	March 21	14th	March 22	
						451	March 23	16th	March 23	
169	2	411	March 8	March 9	4th	462	March 28	23rd	March 28	
255	4	435	March 13	March 17	8th	465	March 29	—	—	Remained at home.
150	4	439	March 17	March 10	9th	471	April 1	22nd	April 1	
						472	April 1	22nd	April 1	
—		444	March 20	March 21	5th	461	March 28	12th	March 28	
274	4	464	March 29	March 30	4th	490	April 11	15th	April 15	
166	6	494	April 23	April 23	3rd					
		495	April 23	April 23	3rd					
		496	April 23	April 23	3rd					
		497	April 23	April 23	3rd					
		498	April 23	April 23	3rd					
147	2	499	April 23	April 23	3rd	503	April 28	8th	April 29	Reckoned as "initial cases."
151	5	485	April 27	April 28	4th	533	May 10	13th	May 10	No. 485 first admitted to hospital April 12th with varicella and discharged April 25th.
300	6	528	May 1	May 2	4th	537	May 15	16th	May 16	
						547	July 4		July 4	Fresh infection.
295	7	530	May 5	May 5	5th	544	May 23	23rd	May 24	
298	10	532	May 5	May 6	4th	539	May 16	14th	May 16	
						540	May 19	17th	May 20	
299	9	535	May 11	May 11	4th	542	May 22	15th	May 23	
						543	May 23	16th	May 25	
						545	May 31	24th	June 1	
301	6	548	July 20	July 24	9th	550	July 31	16th	Aug. 2	
						551	Aug. 1	17th	Aug. 4	
						552	Aug. 5	21st	Aug. 4	
						553	Aug. 6	22nd	Aug. 4	
271	9	351	?	Feb. 24	5th	350	Feb. 25	4th	Feb. 24	Reckoned as "initial case."
36	5	273	?	Feb. 4	4th	335	Feb. 19	19th	Feb. 29	
						366	Feb. 24	24th	Feb. 24	
						374	Feb. 26	26th	Feb. 26	

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TABLE XLVI.

MULTIPLE CASES in HOUSEHOLDS showing DAY OF ILLNESS on which RASH appeared in the first and subsequent Cases, with reference to the Date of the first Case.

Series B.

House.	Number of Inmates.	Initial Case.			Later Case or Cases.				Remarks.
		Reference to Register.	Date of Rash.	Day of Illness.	Reference to Register.	Date of Rash.	Day of Attack of Initial Case.	Date of Removal.	
266	7	10	June 13	4th	13	July 7	24th	July 3	Accompanied No. 14.
					14	July 3	20th	July 3.	
22	5	29	Nov. 17	2nd	31	Dec. 4	19th	Dec. 10.	
3	5	28	? About Nov. 17	?	504	Dec. 8	?	Dec. 7.	
131	5	27	Nov. 24	4th	32	Dec. 6	16th	Dec. 13.	
					35	Dec. 6	16th	Dec. 10.	
					36	? Dec. 9	19th	Dec. 10.	
203	9	76	Dec. 23	5th	111	Jan. 5	18th	Jan. 7.	
					112	Jan. 5	18th	Jan. 7.	
					185	Jan. 23	36th	Jan. 23.	
170	9	69	Dec. 31	2nd	404	March 7		March 7.	Fresh infection ?
199	8	107	Jan. 4	4th	278	Feb. 5	36th	Feb. 6.	
98	6	95	Jan. 3	6th	165	Jan. 15	18th	—	Remained at home.
		101	Jan. 4	3rd	511	Jan. 25	28th	—	
					397	March 4		March 4	Probably infected by No. 165 or 511.
192	4	508	Jan. 7	4th	515	Jan. 27	24th	Jan. 28.	
102	7	196	Jan. 22	4th	396	March 4	46th	March 5.	
					458	March 27		March 28	? Fresh infection.
219	7	254	Feb. 1	4th	316	Feb. 15	19th	Feb. 19.	
		256	Feb. 1	4th					
40	7	217	Jan. 26	2nd	317	Feb. 11	18th	—	Remained at home.
					334	Feb. 16	25th	—	
					428	March 15		March 15.	
—	—	157	Jan. 15	4th	531	May 5		May 5.	Fresh infection ?
—	—	274	Feb. 4	4th	455	March 24	53rd	March 24.	
94	7	303	Feb. 10	4th	352	Feb. 23	17th	Feb. 23.	
208	3	357	Feb. 24	4th	423	March 10	19th	March 24.	
290	10	408	March 6	4th	483	March 23	21st	March 24.	
—	—	387	March 1	3rd	468	March 30	33rd	March 30.	
15	9	386	March 2	4th	488	April 12	45th	April 14.	
275	6	477	April 5	5th	526	May 2	32nd	May 2.	
297	6	527	May 1	3rd	541	May 19	22nd	May 20.	
214	6	26	Nov. 27	4th	34	Dec. 8	15th	Dec. 9.	
					39	Dec. 10	17th	Dec. 10.	
					40	Dec. 10	17th	Dec. 10.	
13	5	131	Jan. 8	3rd	216	Jan. 24	19th	—	Remained at home.
					230	? Jan. 24		Jan. 28.	
96	3	151	Jan. 13	4th	269	Jan. 31	22nd	Feb. 3.	

TABLE XLVII.

MULTIPLE CASES in HOUSEHOLDS—Cases treated at Home—dates of ONSET and RASH in First Cases and in later cases—with reference to Day of Attack of first Cases.

Small-pox at Batley, 1891–2.

Series C.

House.	Number of Inmates.	Initial Cases.			Later Cases.				Remarks.
		Reference to Register.	Date of Onset.	Date of Rash.	Reference to Register.	Date of Onset.	Day of Attack of Initial Case.	Date of Rash.	
136	6	16	July 29	July 31	19	Aug. 15	18th	Aug. 17.	
245	6	17	Aug. 2	Aug. 6	21	Aug. 18	17th	Aug. 21.	
					22	Aug. 21	20th	Aug. 25.	
					23	Jan. 22		Jan. 28	Fresh infection probably.
—	—	23	About Sept. 6		24	About Sept. 19			No exact information.
1	4	25	Nov. 16	Nov. 19	30	Dec. 1	16th	Dec. 4	
215	4	66	Dec. 4	Dec. 7	75	Dec. 7	4th	Dec. 10	Reckoned as initial case.
2	4	43	Dec. 6	Dec. 10	45	Dec. 10	5th	Dec. 13	Reckoned as initial case.
211	10	52	Dec. 11	Dec. 14	63	Dec. 15	5th	Dec. 18.	Reckoned as initial cases.
		53	Dec. 11	Dec. 14	64	Dec. 15	5th	Dec. 18.	
135	8	48	Dec. 11	Dec. 13	83	Dec. 26	16th	Dec. 28.	
					84	Dec. 29	19th	Dec. 31.	
—	—	46	Dec. 9	Dec. 12	174	Jan. 15	38th	Jan. 18.	
127	10	50	Dec. 12	Dec. 15	109	Dec. 28	17th	Jan. 1.	
					187	Jan. 19	39th	Jan. 22.	
					188	Jan. 19	39th	Jan. 22.	
					189	Jan. 19	39th	Jan. 22.	
					201	Jan. 18	38th	Jan. 23.	
258	7	55	Dec. 12	Dec. 15	142	Jan. 8	28th	Jan. 11.	
					336	Jan. 26	46th	Jan. 29.	
—	—	61	Dec. 13	Dec. 16	89	Dec. 30	18th	Jan. 1.	
52	6	86	Dec. 15	?	129	Jan. 5	22nd	?	
50	8	74	Dec. 17		103	Jan. 1	16th	Jan. 5.	
					102	Jan. 4	19th	?	
					104	Jan. 4	19th	?	
209	6	65	Dec. 15	Dec. 18	108	Jan. 1	18th	Jan. 4.	
					516	Jan. 26	43rd	Jan. 28.	
124	4	94	Dec. 26	Dec. 28	152	Jan. 11	17th	Jan. 14.	
					229	Jan. 26	32nd	Jan. 28.	
260	2	92	Jan. 1	Jan. 2					
		93	Dec. 30	Jan. 1					
125	4	115	Jan. 2	Jan. 5					
		117	Jan. 2	Jan. 5					
—	—	113	Jan. 1	Jan. 5	134	Jan. 7	7th	Jan. 10	
59	4	116	Dec. 31	Jan. 3	510	Jan. 10	11th	Jan. 13	
—	—	83	Dec. 26	Dec. 28	202	Jan. 15	21st	Jan. 18	
218	4	114	Jan. 1	Jan. 5	514	Jan. 22	22nd	Jan. 26	
62	7	119	Jan. 2	Jan. 5	211	Jan. 22	21st	Jan. 26	

Small-pox at Batley, 1891-2.

MULTIPLE CASES IN HOUSEHOLDS, &c.—*cont.*

House.	Number of Inmates.	Initial Cases.			Later Cases.				Remarks.
		Reference to Register.	Date of Onset.	Date of Rash.	Reference to Register.	Date of Onset.	Day of Attack of Initial Cases.	Date of Rash.	
248	6	99	Dec. 30	?	182	Jan. 17	19th	Jan. 20.	
		100	Dec. 30	Jan. 1	105	Jan. 20	22nd	Jan. 22.	
73	6	135	Jan. 2	Jan. 10	186	Jan. 19	18th	Jan. 22.	
					520	Feb. 5	35th	Feb. 8.	
76	11	96	Dec. 31	Jan. 3	180	Jan. 17	18th	Jan. 20.	
					340	Feb. 18	50th	Feb. 20,	
196	8	124	Jan. 3	Jan. 6					
		126	Jan. 3	Jan. 6					
210	5	123	Jan. 3	Jan. 6	204	Jan. 21	19th	Jan. 24.	
					512	Jan. 21	19th	Jan. 24.	
					513	Jan. 21	19th	Jan. 24.	
82	6	140	Jan. 5	Jan. 10	233	Jan. 28	24th	Jan. 29.	
212	5	231	Jan. 5	Jan. 8	281	Jan. 17	13th	Jan. 20.	
		507	Jan. 3	Jan. 6	224	Jan. 24	21st	Jan. 21.	
128	5	144	Jan. 9	Jan. 12	223	Jan. 24	16th	Jan. 27,	
					308	Feb. 10	33rd	Feb. 12.	
177	4	173	Jan. 14	Jan. 18	197	Jan. 19	6th	Jan. 22,	
		178	Jan. 16	Jan. 19					
—	—	162	Jan. 12	Jan. 16	247	Jan. 27	16th	Jan. 30.	
168	10	169	Jan. 15	Jan. 18	279	Feb. 3	20th	Feb. 5.	
					286	Feb. 3	20th	Feb. 7.	
					287	Feb. 5	22nd	Feb. 7.	
					288	Feb. 5	22nd	Feb. 7.	
					289	Feb. 5	22nd	Feb. 7.	
142	8	156	Jan. 11	Jan. 14	518	Jan. 29	19th	Feb. 1.	
					257	Jan. 29	19th	Feb. 1.	
					332	Feb. 16	37th	Feb. 18.	
—	—	194	Jan. 18	?	203	Jan. 18		?.	
197	5	221	Jan. 20	Jan. 27	299	Feb. 7	19th	Feb. 10.	
		222	Jan. 22	Jan. 25					
87	9	206	Jan. 22	Jan. 24	290	Feb. 5	15th	Feb, 6.	
					296	Feb. 6	16th	Feb. 9.	
					519	Feb. 10	20th	Feb. 13.	
113	5	208	Jan. 20	Jan. 21	307	Feb. 8	20th	Feb. 9.	
					309	Feb. 7	19th	Feb. 12.	
					312	Feb. 11	23rd	Feb. 12.	
—	—	226	Jan. 23	Jan. 27	282	Feb. 2	11th	Feb. 6.	
27	4	228	Jan. 26	Jan. 28	291	Feb. 5	11th	Feb. 8.	
91		246	Jan. 29	Jan. 30	267	Feb. 1	4th	Feb. 2.	Reckoned as "initial" case.
—	—	225	Jan. 24	Jan. 28	304	Feb. [illegible]	15th	Feb. 11.	
204	5	255	Jan. 29	Feb. 1	301	Feb. 7	10th	Feb. 10.	
173		234	Jan. 27	Jan. 29	313	Feb. 11	16th	Feb. 13.	
					319	Feb. 13	18th	Feb. 15.	
					320	Feb. 13	18th	Feb. 15.	

Small-pox at Batley, 1891-2.

MULTIPLE CASES IN HOUSEHOLDS, &c.—*cont.*

House.	Number of Inmates.	Initial Cases.			Later Cases.				Remarks.
		Reference to Register.	Date of Onset.	Date of Rash.	Reference to Register.	Date of Onset.	Day of Attack of Initial Case.	Date of Rash.	
182	7	253	Jan. 29	Jan. 31	330	Feb. 14	17th	Feb. 17.	
21	4	517	Jan. 27	Jan. 30	329	Feb. 14	19th	Feb. 17.	
					337	Feb. 16	21st	Feb. 19.	
57	8	220	Jan. 25	Jan. 27	310	Feb. 9	16th	Feb. 12.	
		239	Jan. 27	Jan. 29	314	Feb. 10	17th	Feb. 12.	
					348	Feb. 19	26th	Feb. 22.	
60	8	241	Jan. 27	Jan. 28	370	Feb. 22	27th	Feb. 25.	
58	2	293	Feb. 3	Feb. 6					
		300	Feb. 5	Feb. 8					
234	10	283	Feb. 4	Feb. 6	355	Feb. 22	19th	Feb. 23.	
164	6	272	Feb. 3	Feb. 4	305	Feb. 9	8th	Feb. 11	Reckoned as "initial" case.
		280	Feb. 2	Feb. 5	360	Feb. 21	20th	Feb. 24.	
88	5	311	Feb. 10	?	369	Feb. 22	13th	?.	
175	5	321	Feb. 12	Feb. 15	460	March 24	42nd	March 26.	
33	4	318	Feb. 14	Feb. 17	521	? Feb. 28	15th	March 10.	
28	4	354	Feb. 21	Feb. 23	409	March 5	14th	March 8.	
159	8	407	March 2	?	522	March 9	8th	March 9.	Reckoned as "initial" case.
					523	March 23	22nd	March 25.	
					524	April 6	36th	?	
83	6	433	March 11	March 13	478	April 2	23rd	April 5.	
176	2	442	March 17	March 20					
		443	March 15	March 20					

SUMMARY ANALYSIS of TABLES XLV. to XLVII.

—	Households of which particulars obtained.					
	No. of Houses.	No. of Inmates.	Initial Cases		Later cases	
			Removed.	Remained.	Removed.	Remained.
Single cases	159	801	81	78	—	—
Multiple cases Series A.	37	226	53	1*	44	6
Multiple cases „ B.	21	134	—	23	29	5
Multiple cases „ C.	50	295	—	69	—	76
	267	1,456	134	171	73	87
	Households of which no particulars obtained.					
Single cases	42	—	24	18	—	—
Multiple cases Series A.	6	—	7	—	4	2
Multiple cases „ B.	3	—	—	3	—	3
Multiple cases „ C.	9	—	—	9	—	9
	60	—	31	30	4	14
Case arising in hospital	—	—	1	—	—	—
	—	—	32	—	—	—

* This case sickened three days after removal of first case (Nos. 244 and 209).

Small-pox at Batley, 1891-2.

Particulars were obtained of the inmates of 108 of these houses, numbering 655 in all, of whom 306 were attacked with small-pox.

In Series A. there were 37 houses, in five of which, namely, Nos. 39, 264, 157, 166, and 371 in House List, containing 32 inmates, there occurred 16 cases all of which were removed at the same time, no others subsequently arising in those houses. The remaining 32 households containing 194 inmates, yielded 88 cases of small-pox, 38 of which may be regarded as "initial" cases. Subtracting 38 from 194 we have 156 persons who may be presumed to have been exposed to infection; and of these 50 or 32 *per cent.* were attacked subsequently to the removal to hospital of the initial case.

In Series B. there were 21 houses containing 134 inmates, amongst whom 57 contracted small-pox, 23 of whom may be regarded as "initial cases." Subtracting 23 from 134, we have 111 persons who were exposed to infection from the initial case, which was retained at home. Of this number 34 or 30·6 *per cent.* were attacked with small-pox, and the majority of them were removed.

In Series C. there were 50 houses containing 295 inmates, amongst whom 145 contracted small-pox, 69 being regarded as "initial cases." Subtracting 69 from 295, the remainder 226 were exposed to infection at any period after illness of the initial case, and 76 or 33·6 *per cent.* were attacked with small-pox.

Lastly, taking the whole number of 1,456 inmates of 267 infected houses, we find that 305 were "primarily" attacked (in several instances more than one member of a family falling ill within a few days or at the same time as the first). This would leave 1,151 persons subjected to infection (more or less), of which number 160 or 14 per cent. subsequently sickened. And in those houses where the cases were all sent to the hospital (including both single and multiple cases) there would be 500 thus exposed, of whom 50 or 10 per cent. sickened; whilst in those houses where all the cases were retained at home there would be 542 exposed, of whom 78 or 14·4 per cent. sickened.

Vaccination Statistics.

Vaccination data of those attacked with small-pox.

Of the total number (545) small-pox patients at Batley there were:—

A. Vaccinated 347, of whom nine died.

B. Alleged to have been vaccinated, but presenting no marks, 13, of whom one died.

C. "Undergoing" primary vaccination when attacked with small-pox, 8, of whom one died.

D. Unvaccinated 167, of whom 46 died, and E. in 10 instances no information could be obtained respecting vaccination.

The mortality in the foregoing classes was therefore:—

A. Vaccinated - - - - -	2·9	per cent.
B. Alleged vaccination - -	7·7	,,
C. Under vaccination - - -	12·5	,,
D. Unvaccinated - - -	27·5	,,

In the accompanying Table and Chart IX.* the incidence every week of these various classes attacked is illustrated.

TABLE XLVIII.

BATLEY SMALL-POX, 1891–92.

No. of Week of Outbreak.	Vaccinated.		No Information.		"Alleged" Vaccination.		"Under" Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
i.	1	—									1	—
ii.	1	—									1	—
iii.									1	1	1	1
iv.									1	1	1	1
v.									1	—	1	—
vi.												
vii.	3	1	1	—					3	1	7	2
viii.												
ix.												
x.	1	—							1	1	2	1
xi.												
xii.												
xiii.	1	—									1	—
xiv.	1	—									1	—
xv.	1	—									1	—
xvi.	1	—							1	—	2	—
xvii.	2	—									2	—
……											….	….
xx.			1								1	—
xxi.			1	—							1	—
……											….	….
xxx.	1	—							3	3	4	3
xxxi.									1	1	1	1
xxxii.	5	—							1	—	6	—
xxxiii.	19	—	1	—	1	1			6	2	27	3
xxxiv.	7	—							8	3	15	3
xxxv.	5	—			1	—			5	—	11	—
xxxvi.	21	—	2	—			1	—	10	3	34	3
xxxvii.	19	—					3	—	7	1	29	1
xxxviii.	22	1			1	—	1	—	10	3	34	4
xxxix.	29	1	1	—					11	1	41	2
xl.	38	—	2	—	2	—			11	1	53	1
xli.	20	—			1	—	1	—	9	3	31	3
xlii.	16	—							6	2	22	2
xliii.	21	—			1	—	1	1	12	4	35	5
xliv.	18	—			1	—			7	1	26	1
xlv.	16	1			3	—			11	1	30	2
xlvi.	15	2			1	—			7	3	23	5
xlvii.	11	1			1	—			3	1	15	2
xlviii.	9	—							8	2	17	2
xlix.	8	—							6	1	14	1
l.	4	—							2	1	6	1
li.	4	—	1	—					2	—	7	—
lii.	9	—							2	2	11	2
liii.	3	—							3	—	6	—
liv.	3	—							2	1	5	1
lv.	2	—							2	—	4	—
lvi.	6	2									6	2
lvii.												
lviii.									1	—	1	—
lix.												
lx.							1	—			1	—
lxi.												
									1	1	1	1

---

* *Explanation of Chart IX.:—*
This Chart is prepared to show the weekly incidence in Batley of cases of small-pox during the 70 weeks of the epidemic under review, the cases being separately grouped according to their vaccination relations.

The vaccinated *are indicated by the* blue *tint; the* unvaccinated *by the* red. *Those who developed small-pox when undergoing primary vaccination are marked* green. *Those patients who were stated to have been vaccinated, but who showed no evidence of this are indicated by the* yellow *tint. Those about whose vaccination no information was obtainable are indicated by the* brown *tint.*

The above colours are retained uniformly in all the remaining diagrams referring to vaccination.

The fatal cases are indicated thus +.

As far as possible each case is referred to the week in which the earliest symptoms of the disease were manifested.

Chart IX. 1891.—DISTRIBUTION OF CASES WITH RESPECT TO VACCINATION.—1832.

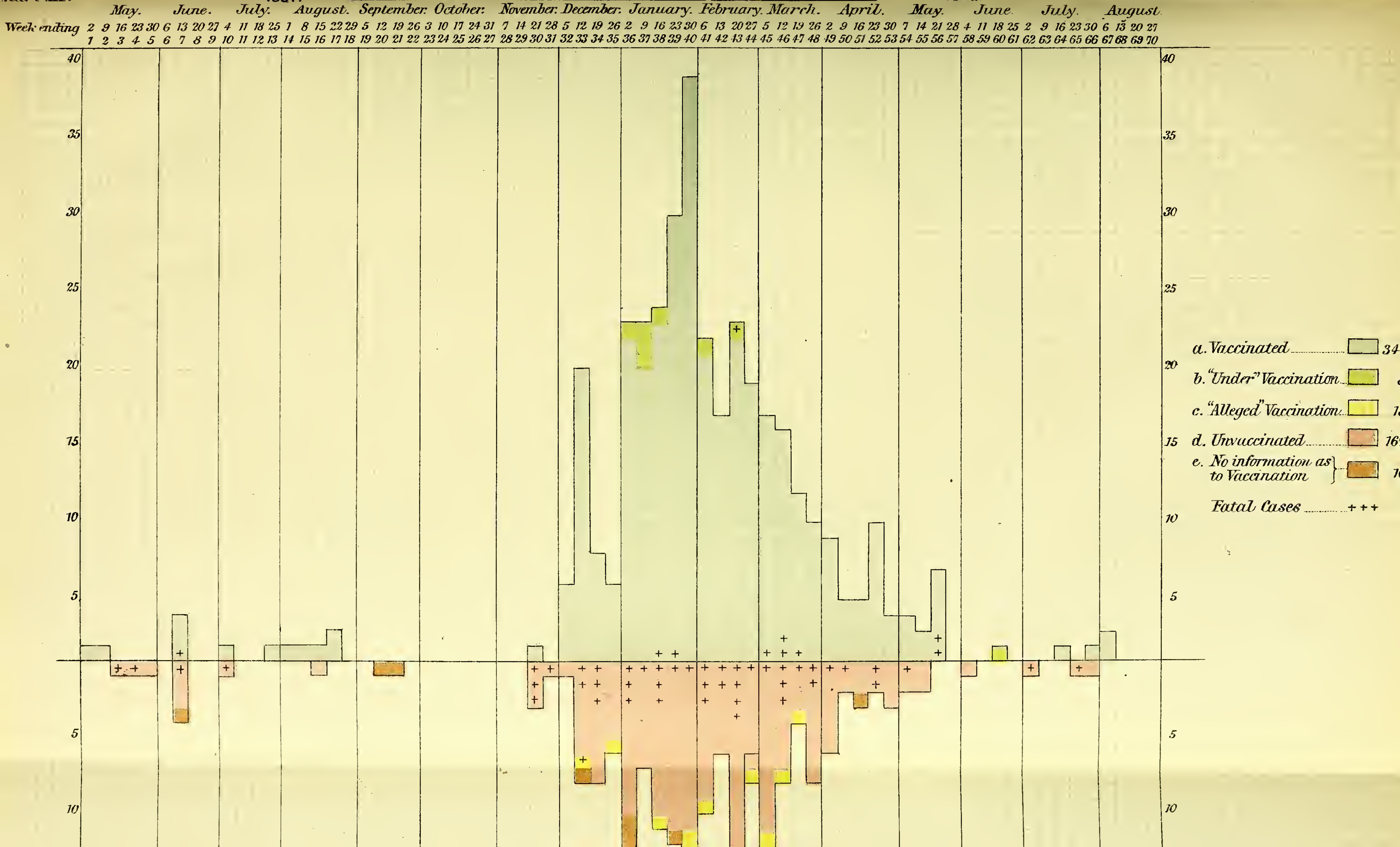
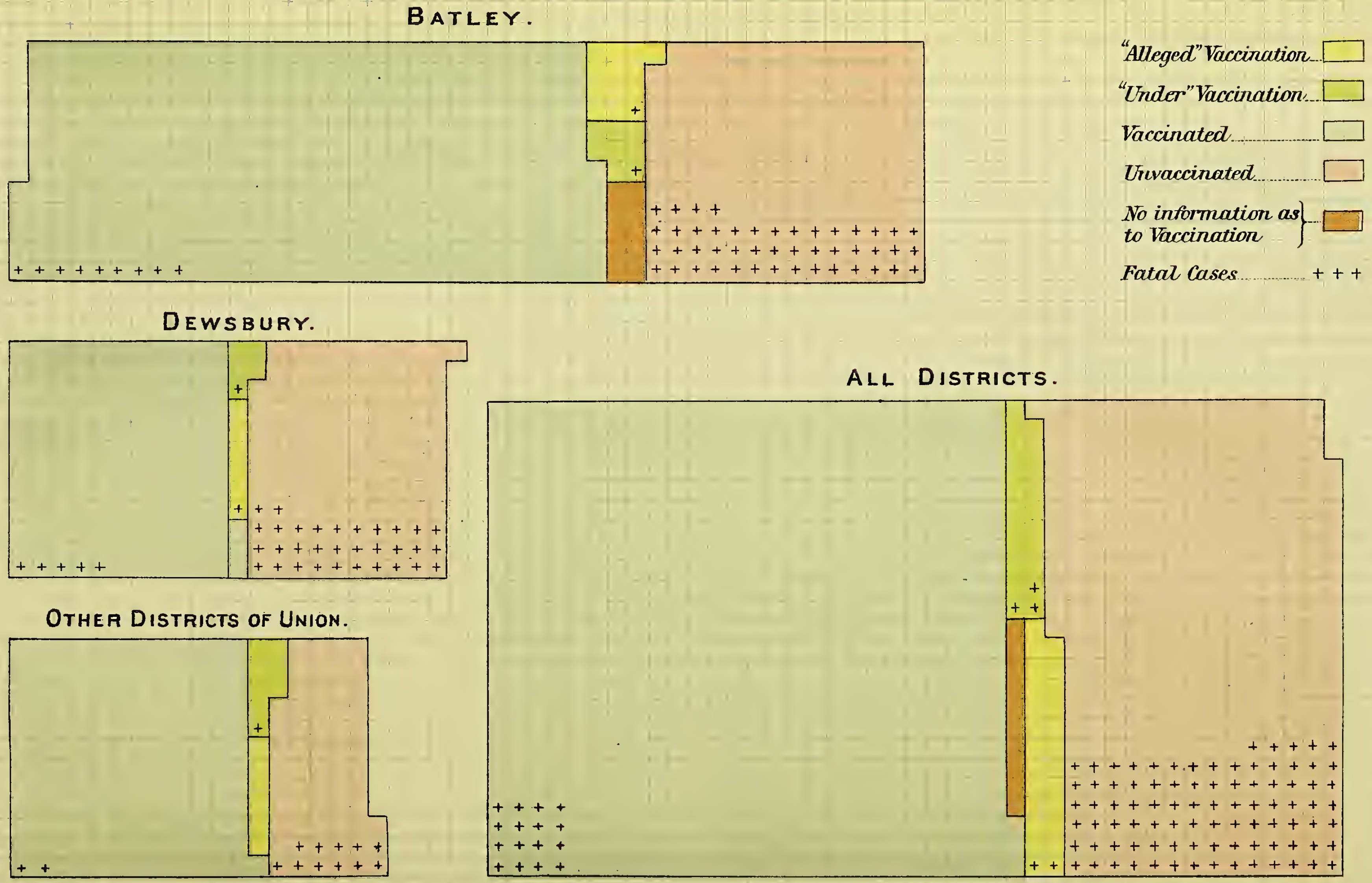


Chart X.

CHART SHEWING VACCINATION-RELATIONS OF CASES OF SMALL POX.



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BATLEY SMALL-POX, 1891-92—*cont.*

No. of Week of Outbreak.	Vaccinated.		·No Information.		"Alleged" Vaccination.		"Under" Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
lxiii.												
lxiv.	1	—									1	—
lxv.									1	1	1	1
lxvi.	1	—							1	—	2	—
lxvii.	2	—									2	—
	347	9	10	—	13	1	8	1	167	46	545	57

In Chart X. the distribution of cases of small-pox amongst the several classes of vaccinated or unvaccinated is depicted*.

The vaccination-relations of those attacked with small-pox at various ages, are given in the annexed Table :—

TABLE XLIX.

Ages of those attacked with Small-Pox in respect to Vaccination.

id
ation.

—	Vaccinated.		No information as to Vaccination.		Alleged Vaccination.		"Under" Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year -	1	—	—	—	—	—	3	1	15	12	19	13
1 to 5 years -	5	—	2	—	—	—	—	—	32	12	39	12
5 to 10 „ -	11	1	2	—	1	—	1	—	25	4	40	5
10 to 15 „ -	40	—	—	—	1	—	2	—	12	2	55	2
15 to 20 „ -	58	2	1	—	—	—	1	—	45	5	105	7
20 to 30 „ -	125	1	2	—	6	1	1	—	25	7	159	9
30 to 40 „ -	68	3	—	—	3	—	—	—	7	2	78	5
40 to 50 „ -	19	—	3	—	—	—	—	—	3	2	25	2
50 to 60 „ -	16	2	—	—	1	—	—	—	1	—	18	2
60 to 70 „ -	3	—	—	—	—	—	—	—	1	—	4	—
70 years and over	1	—	—	—	1	—	—	—	1	—	3	—
	347	9	10	—	13	1	8	1	167	46	545	57

Small-pox at Batley, 1891-2.

or grouped in age-periods :—

—	Under 1 Year.		1 to 10 Years.		10 to 30 Years.		30 and over.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Vaccinated - - -	1	—	16	1	223	3	107	5	347	9
No information as to vaccination.	—	—	4	—	3	—	3	—	10	—
Alleged vaccination -	—	—	1	—	7	1	5	—	13	1
"Under" vaccination -	3	1	1	—	4	—	—	—	8	1
Unvaccinated - -	15	12	57	16	82	14	13	4	167	46
	19	13	79	17	319	18	128	9	545	57

It will be observed that the proportion of the vaccinated increases with the years of age of the subjects, whilst that of the unvaccinated decreases. For at ages—

——	Vaccinated.	Unvaccinated.
	Per Cent.	Per Cent.
Under 1 year - -	5·2	78·9
1 to 10 years - -	29·2	72·1
10 to 30 years -	70·	25·7
30 years and over -	83·7	10·

whilst conversely :—

Of the *vaccinated* :—

0·2 per cent. were at ages under 1 year.
4·6 „ „ „ 1 to 10 years.
64·2 „ „ „ 10 to 30 years.
31·1 „ „ „ 30 years and under.

Of the *unvaccinated* :—

9· per cent. were at ages under 1 year.
34·1 „ „ „ 1 to 10 years.
49·1 „ „ „ 10 to 30 years.
7·7 „ „ „ 30 years and over.

As to the relation between the *type* of the attack of small-pox, and the condition of the attacked persons in regard to vaccination, the following is a summary analysis :—

TABLE L.

TYPE OF SMALL-POX. (*See* Chart XI.)

Confluent.	Confluent.	Coherent.	Discrete.	Mild.	Type not ascertained.
Vacccinated - - -	22	37	158	129	1
No information as to vaccination.	1	1	2	2	4
Alleged vaccination - -	3	1	6	3	—
" Under " vaccination -	3	2	1	2	—
Unvaccinated - -	97	34	30	6	—

In other words, at all ages.

(*a.*) Among the *vaccinated* 6·4 per cent. had confluent small-pox; 10·6 per cent. coherent; 45·5 per cent. discrete ; 37·1 per cent. mild.

(*b.*) Among the *unvaccinated* 58 per cent. had confluent small-pox; 20·3 per cent. coherent; 18 per cent. discrete; 3·6 per cent. mild.

And conversely :—

(*a.*) Of the *confluent* cases, 17·4 were vaccinated; 77 per cent. were unvaccinated.

(*b.*) Of the *coherent* cases, 49·3 per cent. were vaccinated ; 45·3 per cent. were unvaccinated.

(*c.*) Of the *discrete* cases, 80·2 per cent. were vaccinated ; 15·2 per cent. were unvaccinated.

(*d.*) Of the *mild* cases, 90·8 per cent. were vaccinated ; 4·2 per cent. were unvaccinated.

Comparing the vaccination condition of the inmates of 267 invaded houses visited during the inquiry with that of those amongst them who were attacked with small-pox, we find :—

At all ages of 1,456 inmates of the houses:—

1,125 were vaccinated or 77·2 per cent.
18 "alleged" to have been vaccinated.

---

* *Explanation of Chart X.:—*
This Chart shows the actual numbers attacked with small-pox in the period under inquiry, in each of the three divisions employed in the Report, and in all the districts combined; giving the vaccination condition and the mortality amongst these cases.
The chart as expressed in tabular form is as follows:—

—	*Vaccinated.*		*No information as to Vaccination.*		*"Under" Vaccination.*		*"Alleged" Vaccination.*		*Unvaccinated.*	
	Cases.	*Deaths.*	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*
Batley - -	*347*	*9*	*10*	—	*8*	*1*	*13*	*1*	*167*	*46*
Dewsbury - -	*135*	*5*	—	—	*5*	*1*	*6*	*1*	*119*	*32*
Other Districts -	*145*	*2*	—	—	*8*	*1*	*6*	—	*60*	*11*
All Districts -	*627*	*16*	*10*	—	*21*	*3*	*25*	*2*	*346*	*89*

Small-pox at Batley 1891–2.

50 undergoing primary vaccination at time of exposure.
232 un-vaccinated or 15·2 per cent.

and in 31 no information as to vaccination could be obtained.

In the same households amongst the 465 cases of small-pox arising therein, there were:—

296 vaccinated or 63·8 per cent.
13 "alleged" to have been vaccinated.
8 undergoing primary vaccination at time of attack.
144 un-vaccinated or 30·9 per cent.

and in four cases no information as to vaccination could be obtained.

The actual numbers at each age-period being:—

Comparison as to vaccination of the inmates of infected households.

—	Vaccinated.	Alleged Vaccination.	Under Vaccination.	Un-vaccinated.	No information on Vaccination.
Under 1 year.					
Inmates - - -	12	0	9	24	0
Cases - - - -	1	0	3	13	
1 to 10 years					
Inmates - - -	208	1	24	75	4
Cases - - - -	13	1	1	51	2
10 to 30 years.					
Inmates - - -	537	8	15	92	10
Cases - - - -	195	7	4	71	1
30 years and over.					
Inmates - - -	362	9	2	41	14
Cases - - - -	87	5	0	9	1
Age not ascertained.					
Inmates - - -	6	—	—	—	3
Cases - - - -	—	—	—	—	—

Explanation of Chart XI.:—

In this Chart the cases of small-pox occurring in each of the three divisions of the Unions employed in this Report, are analysed with respect (1st) to the type of the attack, and (2nd) with respect to the condition of the subject as regards vaccination.

The particulars upon which the Chart is drawn will be found in Tables XXXIV., L., LXIII. and LXXIX.

It will be seen that the figures at all ages in each district are as follows:—

—	*Confluent.*		*Coherent.*		*Discrete.*		*Mild.*		*Type?*	
	Cases.	*Deaths.*	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*
Batley:										
Vaccinated -	*22*	*8*	*37*	—	*158*	*1*	*129*	—	*1*	—
Under Vaccination.	*3*	*1*	*2*	—	*1*	—	*2*	—	—	—
Alleged Vaccination.	*3*	*1*	*1*	—	*6*	—	*3*	—	—	—
No Information.	*1*	—	*1*	—	*2*	—	*2*	—	*4*	—
Unvaccinated	*97*	*44*	*34*	—	*30*	*2*	*6*	—	—	—
Total - -	*126*	*54*	*75*	—	*197*	*3*	*142*	—	*5*	—
Dewsbury:										
Vaccinated -	*19*	*5*	*11*	—	*40*	—	*63*	—	*2*	—
Under Vaccination.	*2*	*1*	*1*	—	—	—	*1*	—	*1*	—
Alleged Vaccination.	*3*	*1*	*1*	—	*1*	—	*1*	—	—	—
Unvaccinated	*81*	*32*	*19*	—	*17*	—	*2*	—	—	—
Total - -	*105*	*39*	*32*	—	*58*	—	*67*	—	*3*	—
Other Districts:										
Vaccinated -	*3*	*1*	*11*	—	*62*	—	*64*	—	*5*	*1*
Under Vaccination.	*3*	*1*	—	—	—	—	*5*	—	—	—
Alleged Vaccination.	*3*	—	*2*	—	*1*	—	—	—	—	—
Unvaccinated	*33*	*10*	*5*	—	*15*	—	*5*	—	*2*	*1*
Total - -	*42*	*12*	*18*	—	*78*	—	*74*	—	*7*	*2*

On the assumption that these individuals were all equally exposed to the chances of infection, (which is of course not absolutely the case) these figures show:—

1st. That of the *vaccinated* class, the proclivity to the disease under one year of age was as 1 : 12; between 1 and 10 years, as 1 : 16; between 10 and 30 years, as 1 : 2·7; at 30 years and upwards, as 1 : 4·1.

2nd. That of the *un-vaccinated* class, the proclivity under one year of age, was as 1 : 2; from 1 to 10 years as 1 : 1·4; from 10 to 30 years, as 1 : 1·3; at 30 years and upwards, 1 : 4·5.

3rd. That the general proclivity of all classes at—
"under" 1 year was 1 : 2·6.
1 to 10 years was 1 : 4·5.
10 to 30 years was 1 : 2·4.
30 years upwards was 1 : 4·1.

4th. As regards the other classes, at all ages the proclivity amongst the "alleged vaccination"* class was, 1 : 1·8; and amongst the "under" vaccination class, was 1 : 12·1.

A *previous attack of small-pox* had been experienced by 66 of these individuals, viz., 16, between 10 and 30 years of age and 50 at 30 years and over. Of the former, four were vaccinated subjects (including one who was again attacked); in three no information was obtainable as to vaccination (and one of these was again attacked); nine were un-vaccinated. Of the latter, 24 were vaccinated subjects, one belonged to the "alleged" group, and 25 were un-vaccinated (including two who were again attacked.) If one may assume that those who have been vaccinated are on the same plane as to liability to attack as those who have previously had small-pox, the proportions above given may be thus modified:—

Vaccinated or previously had Small-pox.		Not Vaccinated nor had Small-pox.	
10 to 30 years.			
Inmates - -	549	83	
Cases - -	196	71	
	or 1 : 2·8		or 1 : 1·1
30 years upwards.			
Inmates - -	388	16	
Cases - -	89	7	
	or 1 : 4·3		or 1 : 2·3

As regards the question whether vaccinations had any influence in limiting the number of cases of small-pox in households, where the cases were treated at home, and not sent to hospital, I may give here, an analysis similar to that previously given, in respect to the isolation question.

Single Cases in Houses.

(*a*) It may be recalled that facts were obtained, concerning 159 households, in which one member alone suffered from small-pox; and that in 82 of these, the patient was removed to infirmary or hospital, leaving 332 persons who had been more or less intimately in contact with the case.

Of these 82 cases, 56 were vaccinated subjects, 2 were alleged to have been vaccinated, but showed no evidence of it, in 1 case, there is no information as to vaccination. One was undergoing primary vaccination when attacked, and 22 were unvaccinated (one of these being said to have suffered from small-pox in early life).

Of the 332 co-dwellers with these patients, 279 were vaccinated, and 20 of them were successfully re-vaccinated on the removal of the patient; 9 were undergoing vaccination before the case was removed; 2 were alleged to have been vaccinated, and in 3 no information could be obtained. There remain 39 unvaccinated persons, 14 of whom, were submitted to vaccination almost immediately on or after the removal of the case. Lastly of the vaccinated subjects, 6 had previously suffered from small-pox, as also had 13 of the unvaccinated.

(*b*) In 77 households, where a single case occurred, the patient remained at home, together with 310 other persons and in more or less intimate contact with them.

Of these 77 cases, 54 were vaccinated subjects, 2 were undergoing primary vaccination, when attacked with small-pox, and 2 were alleged to have been vaccinated, but showed no evidence; 19 were unvaccinated.

Of the 310 co-dwellers with these patients, 260 were vaccinated, and 31 of them were re-vaccinated successfully shortly after the nature of the case was recognised; 18 were "undergoing vaccination," during the patient's illness

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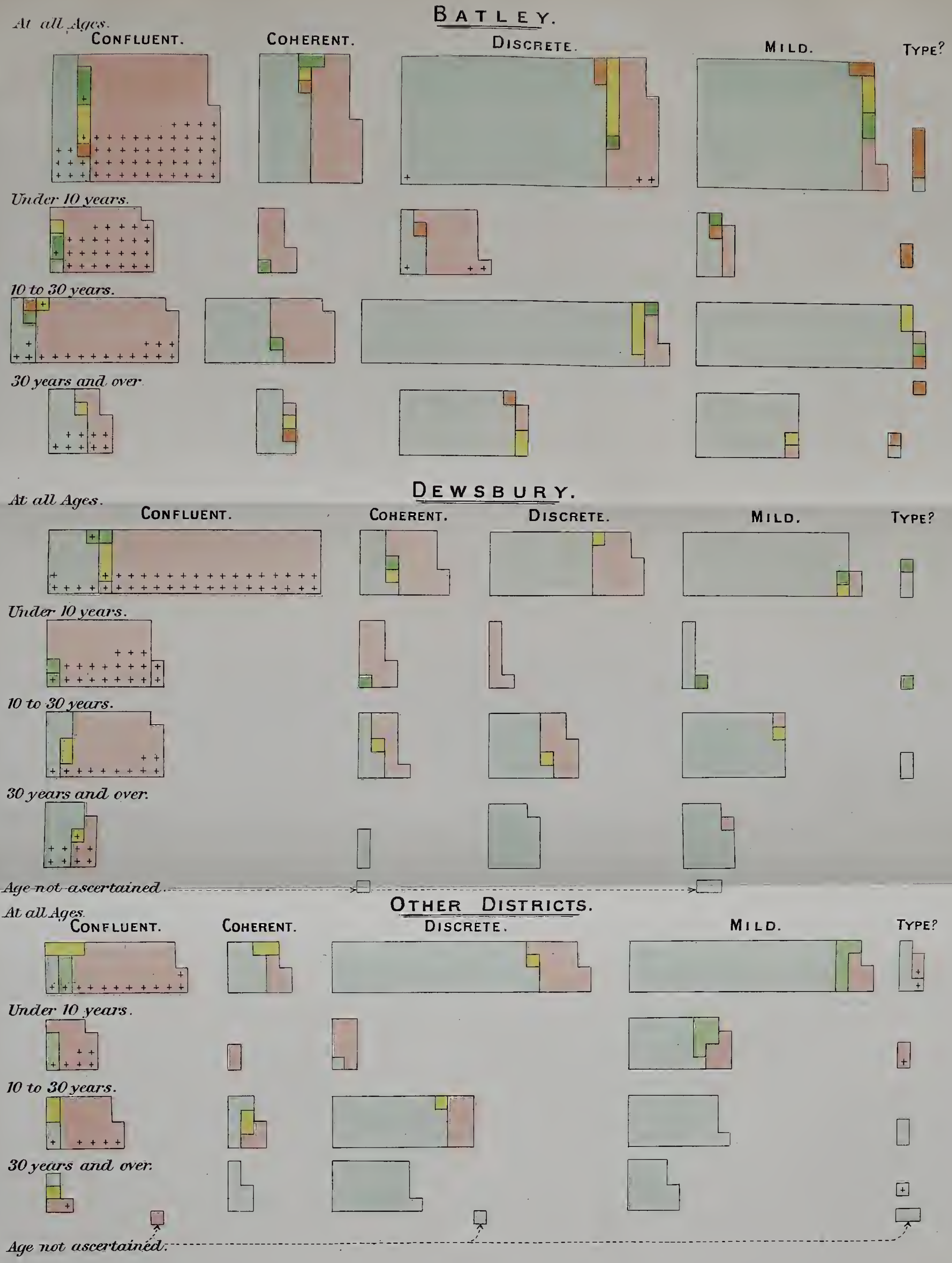
* It should be remembered that this class would probably include more members, if it had been possible to inspect the arms of *every* person.



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having previously been unvaccinated; one was alleged to have been vaccinated, and in 11, no information in this head was obtainable; the remaining 20 were unvaccinated, but 9 of them had previously suffered from small-pox, as also had 13 of the vaccinated persons, and the one "alleged" subject.

In tabular form these facts may be thus stated:—

—	Cases removed to Hospital or Infirmary.		Cases treated at Home.	
	Inmates.		Inmates.	
	Attacked.	Not Attacked.	Attacked.	Not Attacked.
Vaccinated	56	279	54	260
Re-vaccinated before house infected	—	5	—	12
on or after „	—	20	1*	30
Previous small-pox	—	6	1	13
"Under" vaccination	1	9	2	18
"Alleged" vaccination	2	2	2	1
Previous small-pox	—	—	—	1
No information as to vaccination	1	3	—	11
Previous small-pox	1	—	—	—
Unvaccinated	22	39	19	20
Vaccinated on removal of case	—	14	—	—
Previous small-pox	—	12	2	10

* Exposed to infection away from home (Ba. 237).

Multiple Cases in Houses.

Following the plan previously adopted of dividing the families in which more than one case of small-pox occurred into groups—according to whether the cases were isolated at home or in hospital, the following analysis may be made.

Series A.—in which every "initial case"* was removed to hospital and nearly all of the later cases; there were:—

32 houses containing 194 members, from which 38 "initial cases" proceeded. Of these 38 patients
25 were vaccinated.
1 was alleged to be vaccinated but showed no evidence of it.
12 were unvaccinated.

The remaining 156 persons in these houses comprised:—
107 vaccinated, of whom 24 contracted small-pox including three out of five who were re-vaccinated on the removal of the first case. Two had previously had small-pox.
4 were "under" vaccination whilst the initial case was still at home; not one of them contracted small-pox.
6, no information obtainable, no case of small-pox.
1 who was attacked, was said to have been vaccinated, but showed no evidence.
38 were unvaccinated, 25 contracted small-pox and 3 had previously suffered from it;

or stated in tabular form,—

—	Initial Cases removed to Hospital.	Remaining Inmates of 32 houses after removal of Initial Cases.	
		Attacked.	Not Attacked.
Vaccinated	25	24	82
Re-vaccinated before house infected	—	2	1
on or after „	—	1	2
Previous small-pox	—	—	3
Under vaccination	—	—	4
Alleged vaccination	1	1	1
No information as to vaccination	—	—	6
Unvaccinated	12	25	13
Previous small-pox	—	—	3

Series B.—The same method of analysis applied to the comparatively small group of households (21 in number) in which the first to be attacked with small-pox remained at home, the subsequent cases being removed to infirmary of hospitals, yields the following:—

Small-pox at Batley, 1891-2.

21 houses containing 134 inmates; 57 cases of small-pox of whom 23 may be regarded as "initial cases" of small-pox. Of these 23 patients:—
14 were vaccinated.
9 unvaccinated.

The remaining 111 persons in these houses included—
91 who were vaccinated, of whom 23 contracted small-pox. One of the others was re-vaccinated at the time of outbreak of the initial case. Two had had small-pox previously.
2 were "under vaccination" when the initial case was in progress, and one of these contracted small-pox.
In one no information as to vaccination could be obtained.
17 were unvaccinated of whom 10 contracted small-pox, and two had had the disease previously.

Stated in tabular form:—

—	Initial Cases kept at Home.	Other Inmates of 21 houses.	
		Attacked.	Not Attacked.
Vaccinated	14	23	68
Re-vaccinated before house infected	—	—	—
on or after „	—	—	2
Previous small-pox	—	—	4
"Under" vaccination	—	1	1
"Alleged" vaccination	—	—	—
No information as to vaccination	—	—	1
Unvaccinated	9	10	7
Previous small-pox	—	—	2

Series C.—In this series of households having more than one case of small-pox amongst their members, every case being nursed at home, the analysis of vaccination relations is the following:—

50 houses containing 295 inmates of whom 145 had small-pox. 69 of these may be regarded as "initial cases," and of them—
45 were vaccinated.
2 were stated to have been vaccinated, but showed no evidence.
22 were unvaccinated.

The other inmates (226) of these infected houses comprised—
170 who were vaccinated, of whom 46 contracted small-pox. One who was attacked had recently (within a month) been re-vaccinated, and another had been re-vaccinated some years previously; and one had previously had small-pox*(?). 12 of those who were not attacked were re-vaccinated on this occasion.
14 were "under" vaccination at the time there was small-pox in the house, and 4 of them took the disease.
5 were said to have been vaccinated, but had no evidence. 4 contracted small-pox.
In 9 no information as to vaccinations was obtained. Three contracted small-pox; two others had previously had the disease.
28 were unvaccinated, of whom 19 contracted small-pox and five had previously suffered from it.

In tabular form:—

—	Initial Cases.	Other Inmates of 50 houses.	
		Attacked.	Not Attacked.
Vaccinated	45	46	124
Re-vaccinated before house infected	—	2	1
on or after „	—	1	9
Previous small-pox	—	—	1
Under vaccination	—	4	10
Alleged vaccination	2	4	1
No information as to vaccination	—	3	6
Previous small-pox	—	—	2
Unvaccinated	22	19	9
Previous small-pox	—	—	5

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* With one exception, viz., No. 244. *Vide supra.*

* This person had been employed formerly as a nurse at a small-pox hospital, where she said that she had seven (*sic*) mild attacks.

Small-pox at Batley, 1891-2.

It may be instructive to contrast these various series of persons exposed to infection, under varied conditions of preventive measures, by a comparison of their respective attack-rates.

For this purpose one may take the group of multiple cases with the exclusion of those denoted "initial cases" as gauging perhaps more accurately the degree of liability to infection after known exposure. Although this necessitates a separation of the "single cases" from the "multiple series," I will add subsequently the figures relating to the former class, and contrast them with the total liability.

Attack Rates of Small-Pox in Households of which the Members were exposed to Infection from a Previous Case occuring in the house.

—	All Classes.	Vaccinated.	Un-vaccinated.
Whole number	Per cent. 32·7	Per cent. 25·3	Per cent. 67·
Series A	32·	22·4	65·8
„ B	30·6	25·2	58·8
„ C	34·2	27·0	74·0

Several, however, had previously suffered from small-pox and deducting these will considerably modify the attack-rates.

—	Proportion of those not attacked, who had had small-pox previously.		Attack Rates, exclusive of those who had had Small-pox previously.		
	Vac-cinated.	Unvac-cinated.	All Classes.	Vac-cinated.	Unvac-cinated.
Whole number	Per cent. 2·9	Per cent. 34·4	Per cent. 33·8	Per cent. 25·7	Per cent. 74·
Series A	3·6	23·	33·3	23·3	71·1
„ B	5·8	28·5	32·3	26·4	66·6
„ C	0·8	55·5	34·8	27·2	82·6

Apart from the marked difference in incidence upon the vaccinated and unvaccinated, a subject more fully dealt with hereafter, the most striking fact shown by these statistics is that of the increasing liability to attack as the conditions of exposure are more marked. For it may be remembered that series A. comprises those households from which each case, as it arose, was removed to hospital, that series B. comprises those households in which the initial case (at least) was retained at home, the remainder mostly being removed; whilst in series C. each case as it arose was kept at home.

It will be observed that the above calculations take no note of those "undergoing primary vaccination" when exposed to or attacked by small-pox, nor of those alleged to have been vaccinated, nor of those of whom no information as to vaccination could be obtained. The numbers are too small to be of much significance, but it may be stated that of those "under" vaccination, all of which were really unvaccinated when small-pox first invaded the household viz., 20, only 5 or 25·5 per cent. were attacked, viz., one out of two in series B., and four out of ten in series C. Thus, so far as the figures go, their liability is almost precisely as that of the "vaccinated class."

Finally reverting to the group of "single cases in houses" it is interesting to observe that the parallelism in the attack rates of (*a*) those households from which the case was removed, and (*b*) those in which it was kept at home, obtains throughout each class. For the sake of comparison I have appended to this table the attack-rates of the other ("multiple") series *inclusive* of the initial cases:—

Attack Rates of Small-pox in Households in which a Single Case occurred, and those in which there were Multiple Cases.

—	All Classes.	Vaccinated.	Un-vaccinated.
Single Cases.			
Whole number	Per cent. 19·8	Per cent. 16·9	Per cent. 41·0
Cases removed	19·8	16·7	36·0
Cases retained	20·0	17·2	48·7
Multiple Cases.			
Whole number including "initial cases."	46·5	39·2	77·0

or excluding persons who had previously had small-pox,—

—	All Classes.	Vaccinated.	Un-vaccinated.
Single Cases.			
Whole number	Per cent. 20·5	Per cent. 17·3	Per cent. 50·3
Cases removed	20·5	17·0	45·8
Cases retained	20·5	17·6	60·7
Multiple Cases.			
Whole number	48·0	40·0	83·6

I may conclude this part by the following list drawn up on the same plan as the previous one, which contains the data on which much that has been given is based. This list is graphically shown in Chart XII.,* where the vaccination facts of the inmates of invaded houses are made plain.

Table LI.

Batley.

List of Households invaded by Small-pox giving the Vaccination Data of their Members and of the Cases of Small-pox occurring amongst them (Chart XII.).

—	Inmates.					Cases of Small-pox.†				
	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
296	1					538				
288	2					71				
56	2					200				
37	2					213				
285	2					214				
10	2					215				
183	2					232				
162	2					248				
137					2					298
148	2					349				
86	1				1	361				
7	2					367				
80	1				1					418
24				1	1				454	
260	1				1	92				93
116	1				1	377				164
58	2					293, 300				
176	2					442, 443				
147	2					499, 503				
169	2					411, 462				
242	3					98				
9	2				1	122				

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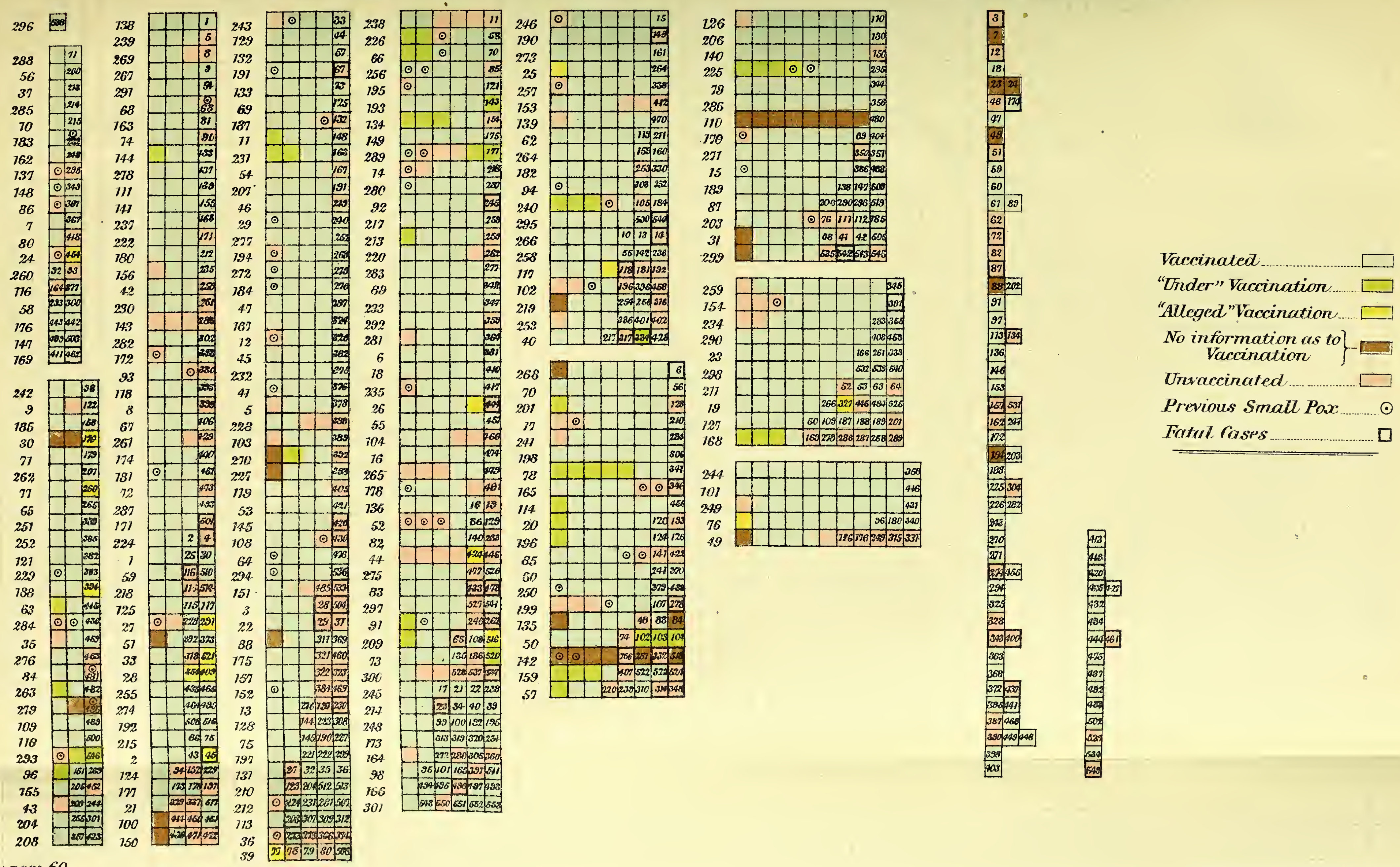
* *Explanation of Chart XII.:—*
This Chart is the counterpart of Chart VII., viz., that in which each household of which there are particulars is represented. But this chart is coloured so as to indicate the condition of every inmate as regards vaccination, the tints employed being the same as those in Charts IX., X., YI., &c.

† The numerals refer to the register of cases.

SMALL POX & OF INMATES OF INVADED HOUSES IN BATLEY.

Chart XII.



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Small-pox at Batley, 1891-2.

LIST of HOUSEHOLDS INVADED by SMALL-POX, &c.—*continued.*

—	Inmates. Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Cases of Small-pox. Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
185	3					158				
30		2		1					170	
71	3					179				
262	3					207				
77	2			1					260	
65	3					265				
251	3					339				
252	3					365				
121	3					382				
229	3					383				
188	2			1					394	
63	2		1			415				
284	2				1	436				
35	2				1	459				
276	2				1					463
84	2				1					481
263	2		1			482				
279	1	2					486			
109	3					489				
115	3					500				
293			2		1			546		
96	2		1			151, 269				
155	2				1	205				452
43	2				1	209, 244				
204	3					255, 301				
208	3					357, 423				
138	4					1				
239	3				1					5
269	2				2					8
267	4					9				
291	4					54				
68	3				1					68
163	4					81				
74	3				1					90
144	3		1			133				
278	4					137				
111	4					139				
141	4					155				
237	4					168				
222	3				1					171
180	4					212				
156	3				1	235				
42	3				1					250
230	3				1					251
143					4					285
282	4					302				
172	3				1	353				
93	2				2					380
118	4					395				
8	3				1					399
67	4					406				
261	2				2					429
174	4					440				
181	4					467				

LIST of HOUSEHOLDS INVADED by SMALL-POX, &c.—*continued.*

—	Inmates. Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Cases of Small-pox. Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
72	3				1					473
287	4					493				
171	3				1					**501**
224	3				1	2				**4**
1	4					25, 30				
59	3				1	510				**116**
218	2				2					114, 514
125	4					115, 117				
27	1			1	2	228			291	
51	3	1				292, 373				
33	2			1	1				521	318
28	2			2					354, 409	
255	4					435, 465				
274	4					464, 490				
192	4					508, 515				
215	4					66, 75				
2	3			1		43			**45**	
124	2				2	229				94 152
177	3				1	173, 178				197
21	2				2	517				329, 337
100	1	1			2	451				414, 450
150	1	1			2	439				471, 472
243	4				1	33				
129	5					44				
132	5					57				
191	4				1					**67**
133	5					73				
69	5					125				
187	3				2					**132**
11	4		1			148				
231	3		2			163				
54	4				1					167
207	5					191				
46	4				1					219
29	5					240				
277	5					252				
194	4				1	263				
272	5					275				
184	5					276				
47	5					297				
167	5					324				
12	4				1	326				
48	5					362				
232	5					375				
41	5					376				
5	4				1	378				
228	2				3					388
103	4				1	389				
270	2	1	1		1					392
227	4	1				393				
119	4				1					405
53	5					421				
145	4				1					**426**
108	3				2					**430**

Small-pox at Batley, 1891-2.

LIST of HOUSEHOLDS INVADED by SMALL-POX, &c.—*continued.*

—	INMATES.					CASES OF SMALL-POX.				
	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
64	5					476				
294	5					536				
151	2				3					485, **533**
3	3				2					**28, 504**
22	3				2					29, 31
88	4	1				311, 369				
175	3				2					321, 460
157	3				2					322, 323
152	3				2					384, 469
13	3				2	216				131, **230**
128	4				1	223, 308				144
75	4				1	145, 227				190
197	5					221, 222 299				
131	4				1	32, 35, 36				**27**
210	4				1	204, 512 513				123
212	4				1	224, 231 281, 507				
113	5					**208,** 307 309, 312				
36	1				4	335				273, 366 374
39	2			1	2	79, 506			77	78, 80
238	2				4					11
226	3		2		1	58				
66	4		2			70				
256					1					85
195	5				1	121				
193	5		1					143		
134	2		3		1					154
149	6					175				
289	1		2		3			177		
14	4				2	218				
280	6					237				
92	5				1					**245**
217	6					258				
213	4		1		1					259
220	4				2					262
283	6					277				
89	6					342				
233	6					347				
292	5				1					359
281	5				1	364				
6	6					381				
18	6					410				
235	5				1	417				
26	4			1	1					447
55	6					457				
104	3				3					466
16	6					474				
265	3				3	479				
178	4				2					491
136	5				1	16				19
52	3				3	86, 129				
82	5				1	140				233
44				1	5				424	446
275	5				1	526				477
83	4				2					**433, 478**

LIST of HOUSEHOLDS INVADED by SMALL-POX, &c.—*continued.*

—	INMATES.					CASES OF SMALL-POX.				
	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
297	5				1	541				527
91	3		1		2					246, **267**
209	3		1	1	1	108			516	**65**
73	4		1		1	135		520		186
300	1				5					528 537 **547**
245	6					17, 21, 22, 238				
214	5				1	34, 39, 40				**26**
248	6					99, 100, 182, 195				
173	6					234, 313, 319, 320				
164	3				3	272, 305				280, 360
98	5				1	95, 101, 165, 511				397
166	5				1	494, 495, 497, 498				**496**
301	5				1	548, 551, 552, 553				550
246	6				1	15				
190	6				1					**149**
273	7					161				
25	6			1		264				
257	6				1	338				
153	4				3					412
139	6				1	470				
62	7					119, 211				
264	7					159, 160				
182	6				1	330				253
94	7					303, 352				
240	2		3		2	184				105
295	7					530, **544**				
266	6				1	10, 13				**14**
258	7					55, 142, 236				
117	3			1	3					**118,** 181 192
102	3				4	396				196, 458
219	5	1			1	254, 256				316
253	5				2	336, 401				402
40	5		1		1	217, 428		**334**		**317**
268	7	1				**6**				
70	8					56				
201	6		1		1					128
17	6				2	210				
241	7				1	284				
198	8					306				
78	3		5			341				
165	5				3					**346**
114	7		1			456				
20	6		1		1	120				193
196	7		1			124, 126				
85	5				3					141, 422
60	8					241, 370				
250	8					379, 438				
199	4				4	107				**278**
135	5	2			1	83	84			48
50	4		3		1			102, 103, 104		74
142		6			2		257, 518			**156, 332**
159	3		3		2	522, 523				407, **524**
57	4		1		3	239, 310				220, **314, 348**

Small-pox at Batley, 1891-2.

List of Households invaded by Small-pox, &c.—*continued.*

—	Inmates.					Cases of Small-pox.				
	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
126	8				1	110				
206	9					130				
140	8				1					150
225	5		3	1		295				
79	9					344				
286	9					356				
110	1	8				480				
170	8				1	69, 404				
271	8				1	351				**350**
15	9					386, 488				
189	9					138, 147, 509				
87	9					206, 290, 296, 519				
203	6				3	112, 185				76, 111
31	7	1			1	38, 42, 505				41
299	6	1			2	**542**, 543				535, 545
259	9				1	345				
154	7				3	**391**				
234	8				2	283, 355				
290	10					408, 453				
23	10					166, 261 333				
298	10					532, 539 540				
211	8				2	. 53, 63				52, 64
19	8			1	1	266, 484 525			327	445
127	9				1	50, 109 187, 188 189				201
168	3		3		4	279, 288				169, 286 287, 289
244	11					358				
101	11					416				
249	10				1	431				
76	10			1		96, 180, 340				
49	4	1			6					106, 176, 249, 315, 331
	1125	31	50	18	232	296	4	8	13	144

Supplementary List of Cases of Small-pox from Houses, Particulars of whose Inmates were not obtained.

—	Vacci-nated.	No Infor-mation.	Under Vacci-nation.	Alleged Vacci-nation.	Unvacci-nated.
High Street - -					**3**
Cullingworth Street -		7			
Upper North Street -					**12**
Clay Fold - -	18				
Back Chapel Street -		23, 24			
Hume Street - -	**174**				46
Ward's Hill - -	47				
Grosvenor Cottage -		49			
Billcliff Buildings -					**51**
Wheatcroft - -	59				
Hanover Street - -	60				
Crescent Street - -	61, 89				
Dark Lane - -					62

Supplementary List of Cases of Small-pox from Houses, Particulars of whose Inmates were not obtained—*cont.*

—	Vacci-nated.	No Infor-mation.	Under Vacci-nation.	Alleged Vacci-nation.	Unvacci-nated.
Union Street - -					**72**
Hume Street - -					82
Brown's Buildings -					**87**
Carlinghow Lane -	202	88			
Grafton Street - -	91				
Staincliffe - -	97				
Wetherall Street -	113				**134**
Parker's Place - -	136				
Wilton Street - -	146				
Harrison's Fold - -	153				
Woodwell Street -					**157**, 531
Dark Lane - -	247				162
Wilson's Buildings -	172				
Charles Street - -	203	194			
Purlwell Lane - -	198				
Henry Street, B. C. -	225				304
Victoria Street, B. C. -	226, 282				
Hick Lane - -	243				
Woodwell Street -	270				
Warwick Mount -	271				
Brown's Buildings -	455				**274**
Clay Fold - -	294				
Suffolk Street - -	325				
Victoria Street - -					278
Spa Street - -					**343** **400**
Healey Lane - -	363				
Havercroft Fold -	368				
Fearnsides Yard -	372				**437**
Field Hill - -	385, **441**				
Jacob Street - -	468				387
King Street, B. C. -	448, 449				390
Wood Street - -	398				
Back Henrietta Street -	413				
North Street - -	419				
Track Quarry - -	**420**				
Back Hume Street -	425, **427**				
Cross Bank -	432				
Taylor Street - -	434				
New Street - -	444				**461**
Balk Street -	475				
Providence Street -	487				
Bradford Road - -	492				
Albion Street - -	483				
Providence Street -	502				
Bayldon's Place - -					529
Ambler Street - -	534				
Bradford Road - -					**549**
	50	6	—	—	23
Small-pox hospital -	403				
	51	6	—	—	23

Small-pox at Dewsbury: 1891-2.

DEWSBURY.

Number of cases of small-pox in Dewsbury. First case in 8th week of the epidemic. The outbreak among inmates of workhouse infirmary. Particulars of infection of some of the cases. The outbreak in a Board School. List of households invaded, with particulars of ages of members, and those attacked. The sanitary condition of infected houses. Weekly incidence—monthly prevalence. Age and sex, distribution. Occupations of those attacked. Types of the disease. Number of cases removed to Fever Hospital. Analysis of incidence in 130 households. Comparison of occupations of all inmates of those houses and of those attacked with small-pox. Single and multiple cases in houses. Vaccination statistics of those attacked (a) *according to order of attack,* (b) *according to age,* (c) *according to type of disease,* (d) *according to those exposed but not affected,* (e) *single or multiple cases in houses. Previous attack of small-pox. List of households and vaccination data of their inmates.*

During the period covered by this inquiry there were known to have occurred in Dewsbury 265 cases of small-pox, inclusive of 6 of the inmates of the workhouse infirmary at Staincliffe, the notifications of infectious disease arising in that institution being made to the Dewsbury Authority.

Origin of outbreak.

It was in the 8th week of the outbreak in the Dewsbury Union that the first case occurred in the town. This was the case of a young man, J. L., living in Whitley Street, who was employed at F.'s mill at Staincliffe, adjacent to the Union Workhouse, in the fever block of which there were at the time four cases of small-pox. He was attacked on June 14th, 1891, and a girl working in the same mill from Batley was attacked on June 7th (Batley, Reg. No. 5). On June 23, W. S. (No. 2), a fellow-worker at the same mill, living in Nowell Street, was also attacked. He may have been infected by the preceding case, but that these workers should have been infected from the cases in the workhouse is impossible to prove. At the presumed date of the infection of J. L. there were only two such cases in the fever block, and they had been there for two or three weeks. J. L. was unvaccinated, the rash appeared in his case on June 17, and he was removed to the Dewsbury Fever Hospital on June 19. His mother (No. 13) was attacked on June 30, evidently infected by him. It is remarkable that the third case (A. G. f., æt. 21) notified in Dewsbury, lived at Staincliffe, in a dwelling about 50 or 60 yards from the workhouse infirmary, from which it was separated by fields in which she was accustomed to walk. This patient sickened on July 1st, and at the time of her supposed infection, there would be seven cases in the workhouse fever block, five admitted between June 12th and 16th.

Outbreak in Workhouse infirmary.

It was at this time that some of the inmates of the workhouse infirmary came to be infected, and a few particulars of these cases (for which I am indebted to Dr. Halliwell, the medical officer to the workhouse) may here be given.

Prior to the appearance of small-pox amongst the inmates of the workhouse infirmary, the following patients had been admitted into the "fever" wards adjoining:—

From Batley, Case No. 1. Admitted May 7, discharged July 1.

From Batley, Case No. 2. Admitted May 12, discharged July 26.

From Batley, Case No. 4. Admitted May 26 (died May 30).

From Batley, Case No. 5. Admitted June 12, discharged August 14.

From Batley, Case No. 6. Admitted June 12 (died June 16).

The first patient in the infirmary to be attacked was Hannah D., æt. 20, a cripple, who had long been an inmate. She did not occupy a ward contiguous to the small-pox block, but may possibly have been infected by frequenting the bath-room, which is so situated. She fell ill on June 16 (No. 180 in Dewsbury list), and had an attack of confluent small-pox. Allowing 14 days for the incubation of her illness, there would be at the time of her presumed infection only two small-pox patients in the "fever" block, who, moreover, would have passed the acute stage of their illness.

The next infirmary inmate to be attacked was Rawson D., æt. 14 (No. 181 in Dewsbury list), a phthisical lad who had improved in health since coming to the infirmary, and who, at the time of his contracting small-pox, was engaged in the tailor's shop. He slept in ward 7 of the infirmary, *i.e.*, precisely opposite the fever block, occupying a bed at the opposite end of the ward to that contiguous to the fever block. He sickened on June 24th, and at the time of his presumed infection (on June 11), there were only two cases of small-pox in the fever block. He had a confluent attack, and died on June 30.

The following cases of small-pox were admitted from June 12 to July 5, when the next infirmary inmate took ill:—

From Batley, Case No. 8. Admitted June 15, discharged August 15.

From Batley, Case No. 12. Admitted June 15 (died June 20).

From Soothill Upper, Case No. 1. Admitted June 15, discharged July 27.

From Birstal, Case No. 1. Admitted June 16, discharged about July 20.

From Heckmondwike, Case No. 1. Admitted June 20, discharged about July 20.

From Batley, Case No. 10. Admitted July 4 (convalescent).

From Batley, Case No. 13. Admitted July 4, discharged August 7.

From Batley, Case No. 14. Admitted July 4 (died July 8).

On July 5 a third inmate of the infirmary was attacked with small-pox, viz., Wm. B., æt. 27 (No. 182 in Dewsbury list), an epileptic, long an inmate (unvaccinated). He occupied a bed in Ward 5, beneath the window looking on to the small area that divides the main infirmary building from the fever block. Presuming that he was infected about June 22, he could hardly have contracted the disease from R. D., who did not sicken until the 24th, nor from H. D., who was sent to the fever block a week previously. At that time (June 22) there would be in the small-pox block eight cases of small-pox.

On July 7 two more infirmary inmates were attacked, viz., Emily S., æt. 24, and Hannah S., æt. 29 (Nos. 183 and 184 in Dewsbury list). At the presumed date of their infection there would be nine cases in the small-pox wards. Both these women were engaged in the laundry which adjoins the small-pox block, and they slept in wards further removed from that building. H. S., an epileptic (unvaccinated), died on July 17 from her attack of small-pox. E. S. (vaccinated) had a bad confluent attack, and was not discharged until November 7th.

A month elapsed before any other of the infirmary inmates were attacked with small-pox, and, meanwhile, no fresh cases were being admitted to the fever block. This, the last inmate to be infected was Frank J., æt. 20, who was convalescent from a severe attack of facial erysipelas when attacked with small-pox. He occupied a bed in No. 6 ward, beneath the window facing the fever block, and at the presumed date of his infection (he sickened on August 4), there were (probably) 10 cases of small-pox in the building.

Although in the month of December there were admitted from Batley 17 cases of small-pox (viz., one on the 4th, one on 7th, three on 9th, five on 10th, one on 13th, one on 14th, five on 31st), no other infirmary inmate was attacked with the disease.

The following is a list of these admissions:—

From Batley.	Case No. 34.	Admitted December 4th.
„	„ No. 504.	Admitted December 7th.
„	„ Nos. 38, 41, 42.	Admitted December 9th.
„	„ Nos. 31, 35, 36. 39, 40.	Admitted December 10th.
„	„ No. 51.	Admitted December 14th.
„	„ Nos. 77, 78, 80, 505, 506.	Admitted December 31st.

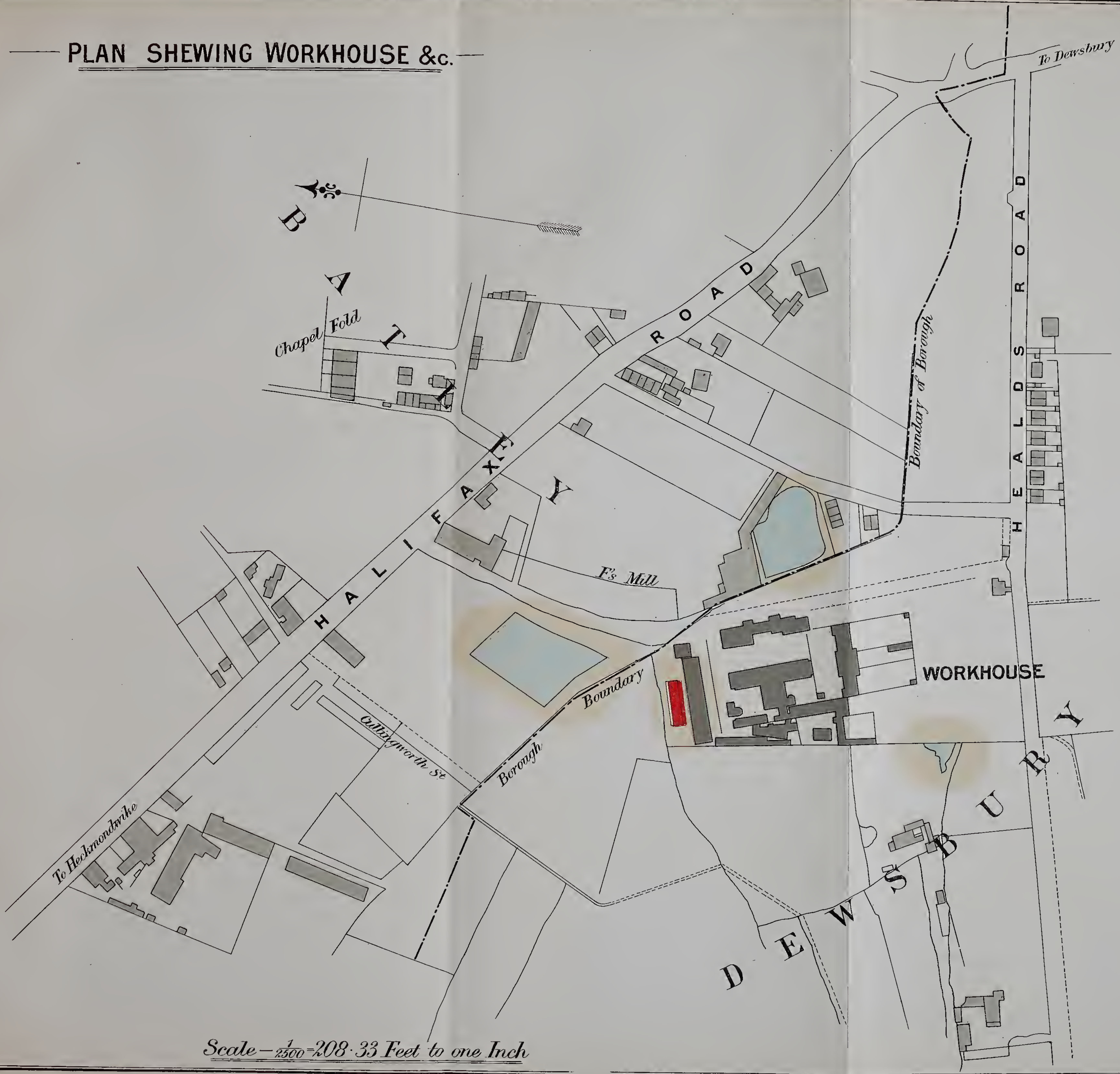
Progr epidem

Returning to the cases arising in Dewsbury, it is only possible to give particulars of a few of them, as to their sources of infection, gathered from personal inquiry made some months afterwards.

M. H., a girl, 15 years of age (No. 9), worked at a mill next to a woman who came from a house where a child had been taken ill (? No. 4, attacked August 1). M. N. was attacked on Aug. 14, and a fellow worker at the same mill (S. S., No. 10), attacked on the same day, died in the hospital. The mother of S. S. (No. 14) was attacked on August 29th, *i.e.*, 12 days after the removal of her daughter to hospital.

No. 12, a child of two years old, living in Nowell Hill Road contracted the disease by visiting a house in the

PLAN SHEWING WORKHOUSE &c.



Scale — $\frac{1}{2500}$ = 208·33 Feet to one Inch

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Wyman & Sons, Ld. Lith. 63 Carter Lane 5819.5.94

same road where a miner (J. A., No. 174) was lying ill. This was one of the few cases not removed to hospital. The child (No. 12) was unvaccinated, she sickened on August 16th (J. A. was ill from July 25 to about August 12th), and died in the hospital on August 26th.

Mrs. H. (No. 17), attacked on September 19th, was inoculated on both nipples by the infant (No. 18) she was suckling at the time; this child being removed to hospital on the 10th three days after its rash appeared. The father (No. 19) was attacked on September 24.

T. M. (No. 24), a dealer in cast-off clothing, fell ill on September 11; he had possibly been infected in the course of his trade.

F. C. (No. 25), a lad employed in a large grocery store, was attacked simultaneously October 18–91, with a companion of his (No. 26), who lived in a district where some cases had recently occurred.

Mrs. W., æt. 75, had a mild attack of small-pox, which occurred on October 18th. She had been nursing some neighbour's children (Nos. 21 and 23), in one of whom the rash appeared on October 5th.

T. W., a delicate unvaccinated child of two years old was admitted into hospital (No.133) on November 25th, in a moribund state. This case had been notified as variola, but was subsequently regarded by the medical attendant as one of "chicken-pox." A sister of this patient, æt. 5, had also had "chicken-pox" two days before. Her case is not included in this record.

R. S., m., æt. 19 (No. 41), a weaver employed in a mill at Batley, sickened on January 9, 1892. He stated that he was working next to a lad whose sister had died from small-pox. [This may be No. 72 in Batley Register, a child who developed the rash on December 21 and died on January 11.]

Mrs. D. (No. 48), living in an open district on high ground may have been infected through her husband who visited houses in Batley to collect rates. She was attacked on January 19. Her sister, Mrs. H. (No. 61), who came to see her before her removal on the 24th, sickened with small-pox on February 4th.

In this month a family of eight members living in the Vulcan Road all suffered excepting the father. The first to be attacked was a lad of 19 (W. H., No. 47), who complained of illness on January 15, and was removed to hospital on the 21st, the day following the appearance of his rash. He was employed as a teamer (carter). His mother and her other five children all developed the rash on February 1st, and were removed to hospital on the 2nd. The two youngest, æt. six and two years respectively, were unvaccinated. These two had confluent attacks; those of Mrs. H. and W. H. were of the coherent type, the rest were mild attacks.

P. H., a plumber, 17 years (No. 49), sickened on January 21. He had visited his brother-in-law in Batley (No. 118 in Batley Register) during the attack of small-pox from which the latter was suffering (rash appeared in this case January 5, and he was removed to hospital January 9, when he died). A brother of P. H. living in Batley (No. 164 in Batley Register) also took the disease (rash, January 16th).

P. H., a miner, æt. 18 (No. 51), attacked on January 29th; was probably infected by a fellow-miner (M. C., No. 45) with whom P. H. sat up one night before his removal to hospital on January 18.

In the month of February a considerable number of cases occurred amongst the children attending one of the largest and best managed elementary schools in Dewsbury. The first known to have sickened was L. N., a girl, 9 years of age (No. 173), living in Ernest Jones Street. She was attacked on February 3rd, and removed to hospital on the 11th; her two brothers, J. N., æt. 5, and E. N., æt. 7 (Nos. 89 and 86), were attacked on the 20th and 21st respectively. On February 5th, B. S., a girl of 12 (No. 68), was attacked and removed to hospital on the 12th. She was unvaccinated and her three sisters and one brother, also unvaccinated and also attending this school, took the disease, the dates of each of their illnesses being February 19th, 22nd, 24th, and 25th respectively (Nos. 88, 90, 91, 93). The father, E. S., a weaver, vaccinated (No. 87), fell ill on February 20th; the only member of the household of seven who escaped being Mrs. S., æt. 35, vaccinated. On February 5th also the head mistress, Miss G., æt. 34 (No. 62), was attacked. She had been in delicate health for the past two years; her infantile vaccination had been unsuccessful, but she was vaccinated successfully at the age of 17. She was removed to the hospital on February 10th, and died there on the 17th. Another teacher, Miss D., of Liversedge, was attacked with discrete small-pox on February 6th (*see* "Liversedge"). On February 7th, T. S., æt. 7 (No. 75), unvaccinated, in the same school and living in Vulcan Road, was attacked; he died in hospital on the 23rd. E. E., a girl, æt. 11 (No. 67), living in Cossham Street, was attacked on February 8th, and removed to hospital on the 12th; she also was unvaccinated, and her brother, æt. 16 (No. 94), vaccinated, fell ill on February 25th. Lastly, on February 15th, a boy of eight years (A. S., No. 74), unvaccinated, living in Vulcan Road, next door but one to his schoolmate, T. S., was attacked with confluent small-pox. The origin of this outbreak is not quite clear. It may have been due to children attending the school from an infected house. I was informed by Mr. A. (brother-in-law to Miss G.) that about a fortnight before her illness, Miss G. noticed that two children were ailing and feverish. She sent them home, and learnt subsequently that there was small-pox in their house; but I have no record of any child at this school having the disease prior to February 3rd in this year; two of the earlier cases in the epidemic (July 1891) were children who did attend there; and subsequent to this period others of the same school were attacked from time to time, but without any such marked evidence of infection at the school as in this series of cases. It is noteworthy, however, that of 57 school children (from all schools) who had small-pox 34 were the first (in 16 instances the *only* case) cases that arose in their respective families.

Small-pox at Dewsbury, 1891–2.

F. P., æt. 18 (No. 70), engaged as a charwoman said that two weeks before she was taken ill (February 8th) she was visited by a friend from Batley, who brought her a present of a fur cape. This friend was employed at a mill where some cases of small-pox had recently occurred. F. P. also stated that Mr. and Mrs. A. at whose house she was working were ill about a week after she was removed to hospital. If their illness was small-pox it must have been so mild as to have passed unrecognised, for there was no notification made of it.

A friend of H. P., viz., K. C. (No. 98), was attacked on February 29th.

H. T., æt. 16 (No. 71), engaged in Postal Telegraph service, living at Woodville, Leeds Road, was attacked February 12th. He had been re-vaccinated a year previously, but it did not take, and he had no clear marks of his primary vaccination. His sister, a dressmaker, æt. 37 (No. 99), sickened on March 1—(H. T. had been removed to hospital on February 15th)—and his brother, æt. 27 (No. 101), on the 3rd. The infection may have been brought to this house by a neighbour (No. 69), who sickened about the same time, and who was occupied as an insurance agent in visiting parts of Dewsbury, then infected with small-pox.

An instance of re-infection of a house may here be cited. It is in a court off High Street, Dawgreen, a block of eight privies being situated in the centre of the unpaved area, surrounded by houses. One of them, a tenement of two rooms, was occupied by a family of nine, of whom A. C., a schoolboy, æt. 10 (No. 73), unvaccinated, was attacked with small-pox on February 16th, and removed to hospital on the 19th, where he stayed for seven weeks. No other case occurred in this dwelling until May 24th, *i.e.*, fully 6 weeks after H. C. had returned home. At this date (May 24th) S. E. C., a school girl, æt. 9 (No. 219), the only other unvaccinated inmate, fell ill, and was removed to hospital on May 28th, where she remained till July 4th.

E. B., f., 16 (No. 96), a weaver, living at Batley Carr, who fell ill on February 25th, worked at a mill next to the sister of a lad who had died in the Batley Small-pox Hospital. (? Batley Reg., 278, admitted to hospital February 6th.)

E. W., m., 20 (No. 97), attacked February 25th, may have been infected through W. H. L. (No. 94), whose sister (No, 67) was removed to hospital on February 12th.

M. A. B., f., 35 (No. 106), a friend of No. 98 (above referred to), was attacked on March 4th; she could hardly, however, have been directly infected by No. 98, but probably indirectly through her from No. 70.

No. 103 is the case of a miner, attacked on March 5th, attributed to infection of the house by a woman who came to stay there whilst her own house was being fumigated. He infected his younger brother, attacked March 19th (No. 126).

No. 111 is the case of the man who drove the hospital ambulance. He had not been re-vaccinated and indeed bore no marks of the vaccination alleged to have been done in infancy. He was attacked on March 8th, removed

Small-pox at Dewsbury, 1891–2.

on the 12th, and remained there till May 7th, having had a confluent attack.

E. H., f., 16 (No. 123), a machinist at a mill in Batley Carr, attacked on March 17th. A fellow-worker living at Batley (Batley Reg., 383) had been taken ill at the end of February.

The occupant of Burgh Mill Farm (No. 136) was attacked on March 27th and died in the hospital on April 8th. He was 21 years of age and unvaccinated. The farm is the nearest dwelling to the hospital, the smoke from which was "often blown over the house."

No. 145 is the case of an infant who was being suckled by its mother, when the latter was attacked with small-pox. The child showed symptoms of the disease on the 14th day of the appearance of the rash on the mother (No. 138).

Mrs. D., wife of the cemetery lodge-keeper, the lodge being situated between the hospital and Crow Nest, was engaged for a month in the capacity of cook at Crow Nest, where convalescing small-pox patients were received. A week after returning home she was attacked with small-pox (No. 141) April 1st, and her husband (No. 147) fell ill on April 13th. His attack was a severe one.

No. 158, attacked April 14th, had visited her relations, the V.'s, at Heckmondwike, three of whom had had small-pox a month previously. (Nos. 11, 14, 15 in Heckmondwike list.)

No. 164 was apparently infected at the hospital where he was engaged in superintending the formation of a road.

In two instances cases of varicella were mistaken for small-pox (and the difficulty in distinguishing the mildest form of the latter from varicella is great), with the result that they were infected in the hospital to which they had been sent. In one of these, eight members of a family of 10 contracted small-pox. B. K., f., æt. 3 (No. 227), sickened on June 1st, 1892, a rash appeared, and she was sent into hospital on June 4th. F. K., f., 9 (No. 244), and F. K., f., 6 (No. 235), a rash in each appeared on the 20th when they were sent into hospital. No. 227 sickened with small-pox on June 25th in the hospital and died on July 3rd. No. 244 returned home on July 2nd, but on the 5th exhibited small-pox papules, and was sent back to hospital on the 8th. No. 235 was still in hospital when she sickened with small-pox on June 27th, and died on July 6th. In the interval (July 2nd to 8th), that F. K. (No. 244) was at home she probably infected the rest of the family who sickened as follows:—July 15, W. K., m., æt. 17 (No. 249); July 17th, L. K., f., 11 (No. 250) July 18, W. K., m., 14 months (No. 251); July 20th, A. K., m., 13 (No. 253); July 21st, F. K., f., 9 (No. 254). All but Nos. 253 and 254 were unvaccinated. The father had had small-pox in boyhood; whilst Mrs. K., who accompanied her infant to the hospital, did not contract the disease.

V. G., f., æt. 23, a weaver, who had been suffering from neuralgia for three weeks, had a rash appear on the fore-arm on July 29, which was thought to be variolous. The case was at once notified and removed. She was discharged from the hospital on August 8th, *i.e.*, the 11th day of her residence there. She felt ill and weak on the 9th, and some undoubted small-pox papules appeared on the 13th, and she was re-admitted into the hospital on the 15th.

I have a few other facts gleaned by inquiry as to the infection of some of the cases, but they are not of material importance.

Number infected househol

Infected Households.—In the following list the houses that were infected are ranged in the order in which the first cases were attacked, the table showing the proportions of the inmates in four age-periods (viz. under 1 year, 1 to 10 years, 10 to 30 years, and 30 years upwards). It will be seen that there were infected in—

——	Houses.	Cases arising in these Houses.
1891.		
June - - -	2	3
July - - -	7	10
August - - -	3	4
September - - -	3	5
October - - -	4	6
November - - -	5	7
December - - -	2	5
	26	40
1892.		
January - - -	12	23
February - - -	26	48
March - - -	23*	36
April - - -	28	46
May - - -	17	26
June - - -	10	20
July - - -	10	12
August - - -	7	7
	133	218

* Also one case at Infirmary.

LIST of HOUSEHOLDS in Dewsbury invaded by Small-pox, in Order of Incidence of the Disease, with Number and Ages of their Members, and of those attacked with Small-pox.

Small-pox at Dewsbury, 1891-2.

Date of Invasion.	Street.	Reference to House List.	All Inmates				Attacked with Small-pox.*			
			Under 1 year.	1 to 10.	10 to 30.	30 years and upwards.	Under 1 year.	1 to 10.	10 to 30,	30 years and upwards.
1891. June 15	Back Whitley Street	29		1	4	2			1	13
„ 24	Nowell Street	56			2	2			2	
July 1	Staincliffe	88		3	2	2			3	
„ 1	Whitley Street	—	—	—	—	—			4	
„ 15	Boothroyd Lane	—	—	—	—	—			7, 8	
„ 16	Thornton Street	12			2	3			30	
„ 22	Whitley Street	28		1	4	2		6		
„ 22	Scout Hill	—	—	—	—	—		**11**	**10**	
„ 23	Nowell Hill Road	46				4				174
August 14	Nowell Hill Road	58		1	5	1			9, 16	
„ 16	Nowell Hill Road	45		1	3	2		**12**		
„ 28	Whitley Street	26		2	2	1			15	
September 3	Whitley Street	27		3	1	2		18		17, 19
„ 4	Carlisle Street	66			4	1			20	
„ 11	Huddersfield Road	16			1	3				24
October 3	Fall Lane	35	1	2	1	2	**23**	21		22
„ 18	Westgate	7		1	6	3			25	
„ 18	Fall Lane	34				2				28
„ 19	Cliffe Road	6		1	4	2			26	
November 3	Leeds Road	—	—	—	—	—			34	**27**
„ 6	Commercial Street	—	—	—	—	—			32	
„ 8	Dewsbury Moor	—	—	—	—	—		29	31	
„ 20	Princes Street	51		3		2		**133**		
„ 30	Middle Road, Daw Green	24	1	3	4	2			33	
December 22	Quarry Road	72		3		2		36, **37**, 38		39
„ 26	School Lane	48		—	1	2			35	
1892. January 1	Heckmondwike Road	—	—	—	—	—				**40**, 46
„ 7	Horsfield Street, Batley Carr	—	—	—	—	—			42	
„ 8	Back Leatham Street	—	—	—	—	—			43, 44	
„ 9	Boothroyd Lane	30			2	3			41	
„ 15	Curry Fold, High Street	41		2	3	4		**66**	45,	
„ 15	Vulcan Road	10		2	4	2		56, 57	47, 52, 53, 54	55
„ 19	Longlands	89	1	1	1	1			48	
„ 19	—— Lane	—	—	—	—	—				178 Age ? 179
„ 21	Low Lane, Batley Carr	64			1	2			49	
„ 23	Newlands	—	—	—	—	—			50	
„ 28	Broughton Lane	61		3	2				58	
„ 29	Middle Street, Daw Green	23		1	3	2			51	
February 2	Thornhill Road	39			1	2			59	
„ 3	Ernest Jones Street	81		4		2		86, 89, 173		
„ 4	Back New Street	44		4	3	2		81	60	
„ 4	Thornhill Road	20		1		2				61
„ 4	Upper Road	69		1	2	1			63	
„ 5	Victoria Road	90		2	1	3				**62**
„ 5	South Woodbine Street	32		2	3	2		91, 93	68, 88, 90	87
„ 7	Vulcan Road	8		2	3	2		**75**		
„ 8	Cossham Street	75			3	1			67, 94	
„ 8	Kensington Street	13			3				70	
„ 9	Back New Street	43		2	4	2			64	
„ 12	Woodville Road	3			3	5			71, 101	99
„ 12	Nowell Hill Road	59			4	2			72	
„ 13	Woodville	4		3	2	2		82, 83		69
„ 15	Vulcan Road	9		1	1	2		74		
„ 16	Ingham Street	42		1	6	2		21		

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* The numerals refer to the Register of Cases.

Small-pox at Dewsbury, 1891-2.

Date of Invasion.	Street.	Reference to House List.	All Inmates.				Attacked with Small-pox.*			
			Under 1 year.	1 to 10.	10 to 30.	30 years and up-wards.	Under 1 year.	1 to 10.	10 to 30.	30 years and upwards.
1892. February 16	Fall Lane	—	—	—	—	—	**76**		95	
,, 19	Tweedale Street	11		1	3	2			77	
,, 20	Scout Hill	78			6	2			78, 80, 84, 85	
,, 22	High Street	40		2	2	2				79
,, 23	Thornhill Road	38		—	2	2				**92**
,, 25	Upper Road, Batley Carr	70		1	2	2			96	
,, 25	Scout Hill	76		2	4	2			97	
,, 27	Kensington Street	14		2	6	2			98, 115, 116, 117	
,, 28	Cemetery Road	86		1	4	2			100	
,, 29	Smith Road, Batley Carr	65		3	1	2		**119**		102
March 4	Back Kensington Street	15		—	2	2				106
,, 5	Huddersfield Road	33		2	2	2		126	103	
,, 5	Scout Hill	79		1	1	3			104	
,, 5	Back Gladstone Street	55		2	3	1		107, 108	129	
,, 5	Quarry Road	73		1		4				110
,, 7	Back Lawson Street	2			1	1			105	
,, 7	Bradford Road, V—— Hotel	—	—	—	—	—			109	
,, 7	Thornhill Road	17			4	2			132, 143	**113**
,, 7	Fall Lane	36			1	3				118
,, 8	Back Cliffe Street	5			2	1			111	
,, 10	Infirmary	—	—	—	—	—			112	
,, 11	Kiln Road	—	—	—	—	—				Age? 114
,, 14	Thomas Street, Batley Carr	67			2	2			134, 135	120
,, 17	Naylor Street, Batley Carr	68		1	5	2			123, 142	
,, 17	Raven Street	49			4	2			125	
,, 17	Gladstone Street	54			5	2			127	
,, 18	Manor Road	25		5	4	2		121, 122		
,, 18	Naylors Fold, Batley Carr	63		2		2				130
,, 20	Halliley Street	31		1	2	1			128	
,, 22	Fall Lane	18		3	3	2		131, **140**, 222		
,, 27	Burgh Mill Lane	80			1	4			**136**	
,, 27	Gladstone Street	52	1	1	2	—	145		138	
,, 28	Lawson Street	1	1	2	1	1		172		148
,, 29	High Street	22			3	? Age 2			137	
April 1	Cemetery Road	85		1	2	2				141, 147
,, 4	Denton Yard, George Street	83			1	1			139	
,, 4	Middle Road	—	—	—	—	—			175	156
,, 7	G—— L—— Inn	—	—	—	—	—			144	
,, 7	Fall Lane	37		2	3				146	
,, 13	Central Street	82		2	3	2		215	152, 187	186
,, 14	Scout Hill	50			1	2				149
,, 14	Nowell Street	84	1	2	6	2			151	
,, 14	George Street	—	—	—	—	—			153	
,, 14	Moor End Lane	62		2	2				158	
,, 15	Scout Hill	77		3	2	2		150, 169, **170**	168, 171	
,, 15	Back Cliffe Street	91		3	2			154		
,, 15	Staincliffe Road	60		3	2	1		176	194, 211	157
,, 16	Long Causeway	71		2	1	2		**220**		155, **201**
,, 18	Fall Lane	19			2	2			159	
,, 18	George Street	—	—	—	—	—			160	
,, 18	Thornhill Road	21			1	2			161	
,, 18	Low Road	—	—	—	—	—				162
,, 22	Ashworth Road	74		1		2				164
,, 22	Gladstone Street	53		3	2	2				**166**, 167
,, 23	Wroe Street	47			3	2				163
,, 23	South Woodbine Street	—	—	—	—	—				Age? 165
,, 26	Whitworth Road	111		3	1	2		191, 202		
,, 28	George Street	100	1		2		**190**		189	

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* The numerals refer to the Register of Cases.

Small-pox at Dewsbury, 1891-2.

Date of Invasion.	Street.	Reference to House List.	All Inmates				Attacked with Small-pox.*			
			Under 1 year.	1 to 10.	10 to 30.	30 years and upwards.	Under 1 year.	1 to 10.	10 to 30.	30 years and upwards.
1892. April 28 - -	Central Street - - - -	99			2	2			196	
„ 29 - -	Ingham Street - - - -	113		1		2		**188**		
„ 29 - -	Long Causeway - - - -	107			2	2			192	
„ 29 - -	Staincliffe Road - - -	121		1	1	2				193, 205
May 1 - -	Ashworth Road - - -	97		3	1	3				**195**
„ 3 - -	Cossham Street - - -	98			2	2			216	198, 218
„ 3 - -	Calder Bank Terrace - -	117		1		2				199
„ 4 - -	Asylum Road - - -	—	—	—	—	—		**207**	197, 208	
„ 6 - -	Bradford Road - - -	124		1		2		200		
„ 10 - -	Back Lawson Street - -	132			1	1			201	
„ 17 - -	Whitworth Road - - -	—	—	—	—	—		206		
„ 19 - -	Smith Road, Batley Carr -	123		2	3	2			209	
„ 20 - -	Hanover Street - -	105		1	7	1			**210**	
„ 20 - -	Senior Street - - - -	112		3	4	1		213		
„ 20 - -	Pitt Street - - - -	109		1	3	2			214	
„ 21 - -	Middle Road - - - -	114			3	2			212	
„ 22 - -	High Street - - - -	95				3				217
„ 24 - -	Lawson Street - - -	125	1			2	**264**			221
„ 25 - -	Fall Lane - - - -	120		2	3	2		229, 230		225
„ 28 - -	West Vale - - - -	116		1	6	2			223, 237	
„ 28 - -	Back Whitley Street - -	—	—	—	—	—				224
June 1 - -	Bradford Road - - -	—	—	—	—	—			226	
„ 1 - -	Caxton Square - - -	127		5	3	2		**227, 235,** 244, 251, 254	249, 250, 253.	
„ 3 - -	Upper Camroyd Street - -	126		1	1	1		228		
„ 11 - -	Whitley Street - - -	104			2				**231**	
„ 12 - -	Back Wood Hill - - -	122		2	3	3		232, **239**	238	
„ 17 - -	Oastler Street - - -	102		1	5	2			**233**	
„ 25 - -	Thornton Street - - -	—	—	—	—	—			236	240
„ 29 - -	Thornhill Road - - -	115	1	2	1	2				
„ 29 - -	Huddersfield Road - -	93		2	3	2		242	**241**	
„ 29 - -	Burgh Mill Farm - -	—	—	—	—	—			243	
July 6 - -	Calder Bank Buildings - -	118			6	2			245	
„ 8 - -	Huddersfield Road - -	94		3	3	2			246, 258	**257**
„ 8 - -	Whitley Street - - -	103			2	1			247	
„ 11 - -	Thornton Street - - -	101		1	3	2		248		
„ 19 - -	Tweedale Street - - -	—	—	—	—	—			252	
„ 20 - -	New Street - - -	110		1	2	1			**252**	
„ 20 - -	Oates Street - - -	106		4	1	1				255
„ 25 - -	Huddersfield Road - -	92			1	3				261
„ 26 - -	Back Fearnley Street - -	—	—	—	—	—	260			
„ 30 - -	Wellington Road - - -	108			1	2			262	
August 1 - -	Thornton Street - - -	129		2	1	1			263	
„ 7 - -	Calder Bank Buildings - -	119		3		2		**265**		
„ 7 - -	Fall Lane - - - -	128			2	2				266
„ 9 - -	Lacey Fold - - -	96			1	2				267
„ 15 - -	Back Belgrave Street - -	130			4	2			268	
„ 21 - -	High Street - - -	—	—	—	—	—			269	
„ 26 - -	Swallow Road - - -	231		1	1	2				270
	Summary.									
	130 Houses visited - -		9	164	298	243	4	57	104	52
	29 Houses not visited - -					Age ? 2	2	4	24	Age ? 8 3
	Infirmary - - - -								1	
	Workhouse inmates (not in the above list), three fatal.								6	
							6	61	135	60

* The numerals refer to the Register of Cases.

Small-pox at Dewsbury, 1891-2.

Sanitary condition of invaded houses.

As regards the *sanitary condition* of the houses which were invaded by small-pox, it is safe to say that it was neither better nor worse than houses situated in the same districts which were not so invaded. Indeed, as regards privy accommodation and ash-pits, the common practice of having one set of middens to a group of houses places many infected and non-infected houses in the same category of exposure to nuisance from defects in the construction or maintenance of such outbuildings.

It may, however, be stated that there were comparatively few infected houses in one of the oldest and worst quarters of Dewsbury, viz., Daw Green, where the streets and courts are narrow and irregular, old and dilapidated, and the sanitary accommodation equally defective. There have been some clearances in this neighbourhood, but it is still densely populated, especially by Irish folk. The neighbouring district of the Flatts, is more open, and covered (partly) by fairly wide paved streets of more modern construction (all, however, on the back-to-back system or in blocks of six, separated by narrow passages). Houses infected by small-pox were more numerous here than in the Daw Green quarter.

There were two parts where the cases were numerous within a small area, and sanitary defects very obvious, viz., in Fall Lane, Thornhill Road— where the privy middens and ashpits were in a very neglected state, and common to many houses, are situated on a higher level than the houses in an unpaved yard—and Scout Hill, off the Huddersfield Road, adjoining Ravensthorpe, where there are water-closets and drains obviously defective. Mr. Hemingway, the Sanitary Inspector of Ravensthorpe, who at the request of the owner had examined this property, told me that he found defects in some of the connexions between the closet soil pipes and the drains, there being nine closets situated in a passage between the houses, and in each case the junction of the soil pipe with the drain was by means of a 4-inch pipe joining the drain obliquely, and merely cemented to the vertical soil pipe by clay. The cellars were saturated with water. At his suggestion these closets were replaced by a trough watercloset, and the drain connexions rectified. These improvements were made subsequently to the time at which the cases of small-pox occurred in this district.

Of the 130 dwellings, of which we have notes, 30 were "through" houses, some being detached.

Six were "partly through," *i.e.*, either having a back entry on the ground floor or a window at the back on the upper floor.

Twenty-two were "single" houses, *i.e.*, with a dead wall at the back.

Seventy-one were "back-to-back" houses.

One was a cellar-dwelling.

So that in at least 94, or more than 70 per cent., there was no through ventilation.*

The proportion of cases was larger in those houses in which there was no through ventilation, for—

Ninety-four dwellings (522 inmates) with no through ventilation yielded 162 cases, or 1·72 per house, and 31 per cent. of all inmates.

Thirty-six dwellings (192 inmates) with partial or complete ventilation, yielded 55 cases, or 1·52 per house, and 28·6 per cent of all inmates; in other words, 100 houses of the first type would at this rate yield 172 cases, 100 houses of the second type 152 cases.

It may be of interest to learn that out of 99 of these houses 64 had privy-middens (49 in number) with ash-pits in connexion, 14 of these being at the time of inspection in bad condition. The remaining 35 had waterclosets (26 in all), some on the trough system, others detached with automatic or voluntary flushing. Many of these were recently constructed, and few, if any, defects could be observed. The ash-pits in connexion were dry and covered. Indeed, there were but few open ash-pits observed.

TABLE LII.

TABLE showing WEEKLY INCIDENCE of Cases of SMALL-POX at Dewsbury (Chart V.).

Week of Epidemic.	Ending	Cases.	Deaths.
viii.	1891. June 20	2	—
ix.	„ 27	2	1
x.	July 4	3	—
xi.	„ 11	3	1
xii.	„ 18	2	—
xiii.	„ 25	3	1
xiv.	August 1	—	—
xv.	„ 8	1	—
xvi.	„ 15	2	1
xvii.	„ 22	2	2
xviii.	„ 29	2	—
xix.	September 5	3	—
xx.	„ 12	1	—
xxi.	„ 19	1	—
xxii.	„ 26	1	—
xxiii.	October 3	1	—
xxiv.	„ 10	—	—
xxv.	„ 17	1	1
xxvi.	„ 24	4	—
xxvii.	„ 31	—	—
xxviii.	November 7	2	1
xxix.	„ 14	1	—
xxx.	„ 21	2	1
xxxi.	„ 28	—	—
xxxii.	December 5	2	—
xxxiii.	„ 12	—	—
xxxiv.	„ 19	—	—
xxxv.	„ 26	2	—
xxxvi.	1892. January 2	2	2
xxxvii.	„ 9	6	—
xxxviii.	„ 16	2	—
xxxix.	„ 23	5	—
xl.	„ 30	8	—
xli.	February 6	7	1
xlii	„ 13	10	2
xliii.	„ 20	12	1
xliv.	„ 27	13	1
xlv.	March	9	—
xlvi.	„ 12	9	1
xlvii.	„ 19	10	1
xlviii.	„ 26	5	—
xlix.	April 2	7	1
l.	„ 9	7	1
li.	„ 16	13	—
lii.	„ 23	9	1
liii.	„ 30	14	3
liv.	May 7	7	2
lv.	„ 14	4	—
lvi.	„ 21	10	2
lvii.	„ 28	10	1
lviii.	June 4	3	1
lix.	„ 11	3	1
lx.	„ 18	2	1
lxi.	„ 25	2	1
lxii.	July 2	9	3
lxiii.	„ 9	3	—
lxiv.	„ 16	2	—
lxv.	„ 23	8	1

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* The average numbers occupying one sleeping room were in houses with through ventilation, 1·2; in those with no through ventilation 3·3 per room.

Small-pox at Dewsbury, 1891-2.

Table LII.—*continued.*

Week of Epidemic.	Ending	Cases.	Deaths.
	1892.		
lxvi.	July 30 - - - -	4	1
lxvii.	August 6 - - - -	1	—
lxviii.	„ 13 - - - -	3	1
lxix.	„ 20 - - - -	1	—
lxx.	„ 27 - - - -	2	—
		265	39

The Monthly Prevalence was as follows:—

—	Cases.	Deaths.
1891.		
June - - -	5	1
July - - -	10	2
August - - -	8	3
September - - -	5	0
October - - -	6	1
November - - -	7	2
December - - -	2	0
1892.		
January - - -	23	2
February - - -	44	5
March - - -	37	3
April - - -	44	5
May - - -	31	5
June - - -	17	7
July - - -	19	2
August - - -	7	1
	265	39

Of the 265 persons attacked with small-pox 131 were males and 134 females; the fatal attacks among the former amounting to 21, and among the latter to 18.

These were distributed according to their ages as follows:—

TABLE LIII.

—	Males.		Females.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year - - -	3	1	3	3	6	4
1 to 5 years - - -	8	4	13	4	21	8
5-10 „ - - -	17	4	23	4	40	8
10-15 „ - - -	20	1	11		31	1
15-20 „ - - -	23	1	26		49	1
20-30 „ - - -	27	4	28	4	55	8
30-40 „ - - -	19	2	15	2	34	4
40-50 „ - - -	9	4	10	1	19	5
50-60 „ - - -	2		2		4	
60-70 „ - - -	1		1		2	
70 and over - - -			1		1	
Age not ascertained - -	2		1		3	
	131	21	134	18	265	39

Or, stated in age-periods:—
Under 1 year: 6 cases, 4 deaths; case mortality 66·6.
1 to 10 years: 61 „ 16 „ „ „ 26·6.
10 to 30 years: 135 „ 10 „ „ „ 7·3.
30 years and over, 60 cases, 9 deaths, case mortality, 15·0.

In other words, the mortality at 30 years and over was twice as high as that of 10 to 30 years; but that from 1 to 10 years was nearly 4 times, and that under 1 year, more than 9 times.

TABLE LIV.

OCCUPATION TABLE—MALES.

Occupations.

—	Under 1 year.	1 to 10 years.	10 to 30 years.	30 years and over.	Age not ascertained.	Total.
AT HOME - - - -	3	7	3	7		20
Of no occupation - -	3	7		1		11
Catholic priest - - -				1		1
Cemetery keeper - -				1		1
Clothier - - - -				1		1
Farmer - - - -			1			1
Greengrocer - - -				1		1
Innkeeper - - -				1		1
Joiner - - - -				1		1
Shopman - - -			1			1
Tobacconist - - -			1			1
AT SCHOOL - - -		18	13			31
AT WORK - - -			51	24	2	77
Mill hands - - -			17	5	1	23
Miner - - - -			14	3		17
Cabdriver - - -			1			1
Cellarman - - -			1			1
Groom - - - -				1		1
Hardware dealer - -				1		1
Hawker - - - -				1		1
Fireman - - - -				2		2
Insurance agent - -				1		1
Joiner - - - -			1			1
Labourer - - -			3	3		6
Messenger (P. O.) - -			1			1
Milkvendor - - -				1		1
Plumber - - - -			1			1
Teamer - - - -			4	1		5
Whitewasher - - -				1		1
Occupation not ascertained -			8	4	1	13
Workhouse Inmate - -			3			3

OCCUPATION TABLE—FEMALES.

—	Under 1 year.	1 to 10 years.	10 to 30 years.	30 years and over.	Age not ascertained.	Total.
AT HOME - - -	3	17	17	23		61
Of no occupation - -	3	17	5	1		
Housewife - - -			10	21		
Confectioner - - -				1		
Dressmaker - - -			1			
Nurse - - - -			1		1	
AT SCHOOL - - -		19	7			26
AT WORK - - -			38	6		44
Mill hand - - -			30	4		34
Ragsorter - - -			6	1		7
Charwoman - - -			1			1
School-teacher - - -				1		1
Occupation not ascertained .			1			
Workhouse Inmate - -			3			3

Small-pox at Dewsbury, 1891-2.

Type of Attack.—On analysing these 265 cases according to their type it is found that there were—

105 confluent cases, or 39·6 per cent.
32 coherent „ 12 „
58 discrete „ 21·9 „
67 mild „ 25·3 „

Type of disease.

The confluent cases were therefore relatively more numerous than in the whole district (see p. 29).

The mortality of the whole number was 14·7 per cent., and was entirely limited to the confluent cases. It may be remembered that the average mortality in the whole district was about 10·7 per cent.

The distribution of these cases at different age-periods was as follows:—

———	Cases.	Per cent.
Under 1 *year of age* - -	6	
Confluent - - -	4	66·6
Coherent - - -	1	16·6
Mild - - -	1	16·6
From 1 *to* 10 *years* - - -	61	
Confluent - - -	38	62·1
Coherent - - -	11	18·
Discrete - - -	6	9·8
Mild - - -	5	8·2
Type not determined -	1	1·6
From 10 *to* 30 *years* - - -	135	
Confluent - - -	44	32·6
Coherent - - -	16	11·8
Discrete - - -	33	24·4
Mild - - -	40	29·6
Type not determined -	2	1·5
At 30 *years and upwards* - -	60	
Confluent - - -	19	31·6
Coherent - - -	3	5·
Discrete - - -	19	31·6
Mild - - -	19	31·
At ages not ascertained - -	3	
Coherent - - -	1	33·3
Mild - - -	2	66·6

Isolation of cases.

All but five cases (two males and three females) were removed to the small-pox hospital, as soon as possible after the notification had been received by the Medical Officer. Subtracting further the six workhouse inmates (three males and three females) of whom three died, there remain 254 cases of small-pox admitted into the hospital during the period of 17 months, of whom 36 died (Chart VIII.).

Table LV.

Dewsbury Small-pox Hospital.

Ages.	Males.		Females.		Total.	
	Cases.	Deaths.	Csses.	Deaths.	Cases.	Deaths.
Under 1 year - - -	3	1	3	3	6	4
1 to 5 years - - -	8	4	13	4	21	8
5 to 10 „ - - -	17	4	23	4	40	8
10 to 15 „ - - -	18	—	11	—	29	—
15 to 20 „ - - -	24	1	25	—	49	1
20 to 30 „ - - -	25	3	25	3	50	6
30 to 40 „ - - -	17	2	15	2	32	4
40 to 50 „ - - -	9	4	9	1	18	5
50 to 60 „ - - -	2	—	2	—	4	—
60 to 70 „ - - -	1	—	1	—	2	—
70 and over - - -	—	—	1	—	1	1
Age not ascertained - -	2	—	—	—	2	—
Total - - -	126	19	128	17	254	36

This hospital also received cases from:—

———	Cases.	Males.	Female
Heckmondwike - - -	29	19	10
Liversedge - - - -	1	—	1
Soothill Nether - - -	13	9	
Soothill Upper - -	14	8	6
Ravensthorpe - - -	17	11	6
Thornhill - - - -	18	9	9

In regard to the question of promptitude in removal to hospital of a case of small-pox, acting as a safeguard against the infection of other members of a family, it is interesting to note that there is no marked difference in the dates of removal of the patients from (*a*) houses where only a single case occurred, and from (*b*) houses where cases followed upon the removal of the initial case. The data are to be found in the table (LVI.) that follows, and they may be summarised thus:—

Group A.

82 houses in which one case only occurred.

1 removed on 2nd day of illness, or 1·2 per cent.
5 „ 3rd „ „ 6·1 „
16 „ 4th „ „ 19·5 „
20 „ 5th „ „ 24·4 „
20 „ 6th „ „ 24·4 „
9 „ 7th „ „ 11·0 „
9 „ 8th „ „ 11·0 „
1 „ 9th „ „ 1·2 „
1 „ 10th „ „ 1·2 „

Group B.

55 hous s where multiple cases, the initial case was removed.

4 removed on 3rd day, or 7·2 per cent.
13 „ 4th „ 23·6 „
11 „ 5th „ 20·0 „
11 „ 6th „ 20·0 „
8 „ 7th „ 14·5 „
6 „ 8th „ 10·9 „
2 „ 9th „ 3·6 „

If anything, there was a prompter removal of the "initial" cases in Group B. than in Group A.*

Table LVI.

Table of Households in which one Case of Small-pox occurred and was removed to Hospital.

House Reference.	No. of Inmates.	Case No.	Date of Rash.	Date of Removal.	Day of Attack on which Removed.
2	2	105	March 9	March 10	4th
34	2	28	Oct. 20	Oct. 21	4th
83	2	139	April 5	April 7	4th
96	2	267†	August 12	August 15	7th
104	2	231	June 14	June 15	5th
5	3	111	March 11	March 12	5th
13	3	70	Feb. 9	Feb. 15	8th
20	3	61	„ 7	„ 9	6th
21	3	161	April 20	April 22	5th
39	3	59	Feb. 5	Feb. 5	3rd
48	3	35	Dec. 28	Jan. 4	10th
50	3	149	April 16	April 17	4th

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* The reckoning is made in each case from the day of attack, and some allowance must, of course, be made for the difficulty of precisely fixing this in all cases. It may be remarked that should these data be correct, the time of appearance of variolous rash is more variable than is generally admitted; for out of 254 cases, in three the rash was said to have appeared on the 1st day of illness, in 21 on the 2nd day, in 91 on the 3rd day, in 89 on the 4th day, in 36 on the 5th day, in 10 on the 6th day, and in 4 on the 7th day.

† Originally admitted July 20 and discharged August 9 for varicella. Contracted small-pox in hospital.

Table LVI.—*continued.*

House Reference.	No. of Inmates.	Case No.	Date of Rash.	Date of Removal.	Day of Attack on which Removed.
64	3	49	Jan. 24	Jan. 25	5th
74	3	164	April 24	April 24	3rd
95	3	217	May 25	May 27	6th
103	3	247	July 13	July 14	7th
108	3	262	August 2	August 6	8th
113	3	118	May 2	May 3	5th
117	3	199	„ 7	„ 9	7th
124	3	200	„ 8	„ 11	6th
126	3	228	June 3	June 10	8th
9	4	74	Feb. 18	Feb. 20	6th
15	4	106	March 8	March 11	8th
16	4	24	Sept. 14	Sept. 17	7th
19	4	159	April 20	April 22	5th
31	4	128	March 24	March 24	5th
36	4	118	„ 9	„ 10	4th
38	4	92	Feb. 25	Feb. 26	4th
56	4	2	June 28	July 1	9th
62	4	158	April 17	Apri 19	6th
63	4	130	March 24	March 25	8th
69	4	63	Feb. 8	Feb. 9	5th
89	4	48	Jan. 20	Jan. 21	3rd
99	4	196	May 3	May 5	8th
107	4	192	„ 1	„ 2	4th
110	4	255	July 22	July 25	6th
128	4	266	August 10	August 11	5th
129	4	263	„ 5	„ 6	6th
131	4	270	„ 28	„ 30	5th
12	5	30	July 18	July 20	5th
22	5	137	April 1	April 2	5th
26	5	15	Sept. 1	Sept. 4	8th
30	5	41	Jan. 10	Jan. 10	2nd
37	5	146	April 10	April 10	4th
47	5	163	„ 25	„ 25	3rd
51	5	133	Nov. 21	Nov. 25	6th
61	5	58	Jan. 30	Feb. 2	6th
66	5	20	Sept. 9	Sept. 9	6th
70	5	96	Feb. 28	March 1	6th
73	5	110	March 10	„ 12	8th
79	5	104	„ 7	„ 9	5th
80	5	136	„ 29	April 1	6th
91	5	154	April 17	„ 19	5th
114	5	212	May 23	May 24	4th
119	5	265	August 9	August 10	4th
11	6	77	Feb. 23	Feb. 24	6th
23	6	51	„ 1	„ 2	5th
40	6	79	„ 24	„ 25	4th
45	6	12	August 17	August 19	4th
49	6	125	March 20	March 23	7th
59	6	72	Feb. 16	Feb. 18	7th
90	6	62	„ 9	„ 10	6th
101	6	248	July 14	July 16	6th
106	6	256	July 23	July 25	6th
115	6	240	„ 1	„ 3	5th
130	6	268	August 18	August 19	4th
6	7	26	Oct. 22	Oct. 22	4th
8	7	75	Feb. 18	Feb. 21	?
28	7	6	July 24	July 24	3rd
54	7	127	March 22	March 23	7th
86	7	109	„ 4	„ 5	7th
88	7	3	July 4	July 8	8th
97	7	195	May 4	May 6	6th
123	7	209	„ 22	„ 23	5th
43	8	64	Feb. 11	Feb. 12	4th
76	8	97	„ 27	March 2	7th
102	8	233	June 19	June 21	5th
112	8	213	May 24	May 24	5th
118	8	245	July 9	July 11	6th
105	9	210	May 23	May 23	4th
7	10	25	Oct. 21	Oct. 23	6th
24	10	33	Dec. 3	Dec. 4	5th
84	11	151	April 16	April 17	4th
—	—	4	July 4	July 6	6th
—	—	32	Nov. 10	Nov. 11	6th
—	—	42	Jan. 11	Jan. 12	6th
—	—	50	„ 26	„ 26	4th
—	—	109	March 10	March 12	6th
—	—	112	„ 12	„ 13	4th
—	—	114	„ 12	„ 13	3rd
—	—	144	April 9	April 13	7th
—	—	153	„ 16	„ 18	5th
—	—	160	„ 20	„ 21	4th
—	—	162	„ 22	„ 23	6th
—	—	165	„ 26	„ 26	4th
—	—	206	May 19	May 21	5th
—	—	224	„ 30	June 1	5th
—	—	226	June 1	„ 2	2nd
—	—	236	„ 28	„ 29	5th
—	—	243	July 2	July 5	7th
—	—	252	„ 21	„ 22	4th
—	—	260	„ 29	„ 29	4th
—	—	269	August 25	August 28	8th

Households in which the Cases not removed to Hospital.

House Reference.	No. of Inmates.	Case.	Onset.	Rash.
46	4	174	July 23	July 25
92	4	261	„ 25	„ 28
109	6	214	May 20	?
—	—	178	Jan. 19	Jan. 22
		179	Feb. 9	Feb. 12

Small-pox at Dewsbury, 1891-2.

TABLE LVII.

TABLE of HOUSEHOLDS in which more than one case of SMALL-POX occurred and were removed to Hospital.

House.		Initial Case.				Later Cases.				Remarks.
Reference to Register.	No. of Inmates.	No. in Register.	Date of Rash.	Date of Removal.	Day of Attack on which removed.	No. in Register.	Date of Onset.	Day of Attack of Initial Case.	Date of Removal.	
29	7	1	June 17.	June 19.	6th.	13	June 30.	17th.	July 1.	
—	—	7	July 17.	July 20.	6th.	8	Aug. 2.	19th.	Aug. 6.	
58	7	9	Aug. 16.	Aug. 17.	4th.	16	Aug. 30.	17th.	Sept. 3.	
—	—	27	Nov. 7.	Nov. 10.	8th.	34	Nov. 21.	19th.	Nov. 26.	
—	—	31	Nov. 12.	Nov. 14.	7th.	29	Nov. 29.	22nd.	Dec. 4.	
—	—	40	Jan. 4.	Jan. 6.	6th.	46	Jan. 17.	17th.	Jan. 21.	
—	—	44 43	Jan. 13. „ 12.	Jan. 14. „ 14.	7th. 6th.					Probably infected from same source.
44	9	60	Feb. 5.	Feb. 6.	3rd.	81	Feb. 19.	16th.	Feb. 22.	
75	4	67	Feb. 11.	Feb. 12.	5th.	94	Feb. 25.	17th.	Feb. 27.	
—	—	76 95	Feb. 20. „ 25.	Feb. 22. March 1.	7th. 8th.					Probably infected from same source.
42	9	73	Feb. 18.	Feb. 19.	4th.	219	May 24.		May 28.	No. 73 left hospital, April 6.
65	6	102	March 4.	March 7.	8th.	119	March 17.	18th.	March 21.	
33	6	103	March 7.	March 9.	5th.	126	March 20.	16th.	March 23.	
68	8	123	March 19.	March 22.	6th.	142	April 5.	20th.	April 10.	
25	11	121 122	March 19. „ 19.	March 21. „ 21.	4th. 4th.					Probably infected from same source.
52	4	138	March 31.	April 2.	7th.	145	April 12.	19th.	April 2.	
1	5	172	March 30.	March 31.	4th.	148	April 13.	17th.	April 16.	
85	5	141	April 4.	April 4.	4th.	147	April 12.	12th.	April 16.	
—	—	175	April 7.	April 10.	7th.	156	April 14.	11th.	April 21.	
53	7	167 166	April 26. „ 26.	April 27. „ 27.	6th. 5th.					Probably infected from same source.
111	6	191	April 29.	May 3.	8th.	202	May 10.	15th.	May 15.	
100	3	189 190	May 2. „ 2.	May 4. „ 4.	7th. 7th.					Probably infected from same source.
121	4	193	May 3.	May 4.	6th.	205	May 12.	10th.	May 17.	
132	2	204 203	May 12. „ 14	May 15. „ 15.	6th. 5th.					Probably infected from same source. Both were rag-pickers.

Small-pox at Dewsbury, 1891-2.

House.		Initial Case.				Later Cases.				Remarks.
Reference to Register.	No. of Inmates.	No. in Regsster.	Date of Rash.	Date of Removal.	Day of Attack on which removed.	No. in Register.	Date of Onset.	Day of Attack of Initial Case.	Date of Removal.	
125	3	221 264	May 25. June 4.	May 28. —	5th.	—	Born in hospital, May 24.			
116	9	223	May 30.	May 31.	4th.	237	June 28.	30th.	July 1.	
93	7	241 242	July 2. „ 3.	July 4. „ 4.	6th. 4th.					No. 242 might have brought infection from school.
—	—	11	July 24.	Aug. 1.	11th.	10 14	Aug. 14. „ 29.	24th. 39th.	Aug. 17. Sept. 3.	
27	6	18	Sept. 7.	Sept. 10.	8th.	17 19	Sept. 19. „ 4.	17th. 22nd.	Sept. 20. „ 25.	
35	6	21	Oct. 5.	Oct. 5.	3rd.	23 22	Oct. 15. „ 20.	13th. 18th.	Oct. 18. „ 27.	
41	9	45	Jan. 17.	Jan. 18.	4th.	65 66	Feb. 10. „ 10.	27th. 27th.	Feb. 13. „ 13.	Possibly an intermediate case unrecognised.
81	6	173	Feb. 7.	Feb. 11.	9th.	86 89	Feb. 20. „ 21.	20th. 21st.	Feb. 24. „ 25.	
3	8	71	Feb. 15.	Feb. 16.	th.	99 101	March 1. „ 3.	19th. 21st.	March 5. „ 6.	
4	7	69 82 83	Feb. 15. „ 21. Feb. 21.	Feb. 15. „ 22. Feb. 22.	3rd. 5th 5th.					No. 69 probably brought contagion home with him.
55	6	108 107	March 8. „ 10.	March 11. „ 11.	7th. 6th.	129	March 21.	17th.	March 24.	Nos. 107 and 108 attended same school.
17	8	113	March 12.	March 13.	7th.	132 143	March 22. April 8.	16th. 33rd.	March 27. April 11.	
67	4	120	March 18.	March 21.	8th.	134 135	March 29. „ 29.	16th. 16th.	April 1. „ 1.	
18	8	131	March 24.	March 25.	4th.	140 222	April 3. May 25.	13th.	April 9. May 30.	No. 131 left hospital about May 7.
71	5	155	April 19.	April 21.	6th.	201 220	May. 3. „ 25.	18th. 40th.	May 12. „ 28.	
98	4	198	May 5.	May 7.	5th.	216 218	May 21. May 25.	19th. 23rd.	May 26. „ 27.	
—	—	197	May 6.	May 8.		207 208	May 17, „ 17.	14th. 14th.	May 21. „ 21.	
120	7	225	May 31.	June 1.	8th.	229 230	June 9. „ 10.	16th. 17th.	June 11. „ 14.	

mall-pox t Dews-bury, 1891–2.

House		Initial Case.				Later Cases.				Remarks.
Reference to Register.	No. of Inmates.	No. in Register.	Date of		Day of Attack on which removed.	No. in Register.	Date of Onset.	Day of Attack of Initial Case.	Date of Removal.	
			Rash.	Removal.						
122	8	232	June 14.	June 17.	6th.	238	June 29.	18th.	July 2.	
						239	„ 29.	18th.	„ 2.	
94	8	246	July 10.	July 13.	6th.	258	July 23.	16th.	July 28.	
						257	„ 25.	18th.	„ 28.	
72	5	39	Dec. 24.	Dec. 29.	8th.	37	Jan. 2.	12th.	Jan. 4.	
						38	„ 4.	14th.	„ 4.	
						36	„ 5.	15th.	„ 4.	
78	8	84	Feb. 23.	Feb. 24.	5th.					The disease probably introduced from school or work-place of one of those attacked.
		85	„ 23.	„ 24.	5th.					
		78	„ 23.	„ 24.	4th.					
		80	„ 26.	„ 27.	4th.					
14	10	98	March 1.	March 4.	7th.	116	March 12.	15th.	March 17.	
						115	„ 14.	17th.	„ 17.	
						117	„ 16.	19th.	„ 20.	
82	7	152	April 15.	April 16.	4th.	187	April 26.	14th.	May 2.	No. 152 returned home from hospital, May 11.
						186	„ 28.	16th.	„ 1.	
						215	May 22.	40th.	„ 26.	
60	6	157	April 19.	April 20.	6th.	176	April 30.	16th.	May 5.	
						194	May 2.	18th.	„ 5.	
						211	„ 20.	36th.	„ 23.	
77	7	150	April 16.	April 17.	3rd.	168	April 27.	13th.	April 29.	
						169	„ 27.	13th.	„ 29.	
						170	„ 27.	13th.	„ 29.	
						171	„ 27.	13th.	„ 30.	
32	7	68	Feb. 7.	Feb. 13.	9th.	87	Feb. 20.	16th.	Feb. 24.	
						88	„ 20.	16th.	„ 24.	
						90	„ 22.	18th.	„ 26.	
						91	„ 22.	18th.	„ 26.	
						93	„ 24.	20th.	„ 27.	
10	8	47	Jan. 21.	Jan. 21.	7th.	55	Jan. 28.	14th.	Feb. 2.	
						56	„ 28.	14th.	„	
						57	„ 28.	14th.	„	
						52	„ 29.	15th.	„	
						53	„ 29.	15th.	„	
						54	„ 29.	15th.	„	
12	10	227	June 26.	June 4.	—	249	July 15.	14th.	July 20.	Nos. 227, 235, 244 sent to hospital suffering from varicella. No. 244 returned home, July 2.
		244	July 5.	July 8.	7th.	250	„ 17.	16th.	„ 20.	
		235	June 29.	June 18.	—	251	„ 18.	17th.	„ 21.	
						253	„ 20.	19th.	„ 23.	
						254	„ 21.	20th.	„ 23.	

Small-pox at Dewsbury, 1891-2.

Of the 265 cases occurring at Dewsbury, six were inmates of the workhouse, one was a nurse at the infirmary, who had contracted small-pox from a man admitted when suffering from the early symptoms of the disease, and the rest, 258 in number, came from 159 houses.

Twenty-nine of these households were not seen from various causes; they contained 41 cases; viz.:—

19 houses having each 1 case, or 19 in all.
8 ,, ,, 2 cases, or 16 ,,
2 ,, ,, 3 ,, 6 ,,

ted holds.

Particulars were obtained from personal visits to 130 households of the 716 inmates they furnished. The distribution of cases of small-pox amongst these households was as follows:—

TABLE LVIII.

Number of Houses.	Number of Inmates to each House.	Number of Cases.								Total.	
		1.	2.	3.	4.	5.	6.	7.	8.	Inmates.	Cases.
2	11	1	1							22	3
4	10	2			1				1	40	14
5	9	1	3	1						45	10
13	8	5	1	5	1			1		104	33
17	7	8	4	2	1	1	1			119	37
20	6	12	3	4	1					120	34
20	5	16	2	1	1					100	27
25	4	20	3	2						100	·32
18	3	16	2							54	20
6	2	5	1							12	7
130		86	20	15	5	1	1	1	1	716	217

The relative proportions of the numbers attacked with small-pox and those occupying the same house may be summarised in the two series of single and multiple (that is, two or more) cases of the disease.
Thus the proportions were in—

—	Single Cases.	Multiple.
Households of 11 members.	50 per cent.	50 per cent.
,, 10 ,,	50 ,,	50 ,,
,, 9 ,,	20 ,,	80 ,,
,, 8 ,,	38·5 ,,	61·5 ,,
,, 7 ,,	47 ,,	53 ,,
,, 6 ,,	60 ,,	40 ,,
,, 5 ,,	80 ,,	20 ,,
,, 4 ,,	80 ,,	20 ,,
,, 3 ,,	88·8 ,,	11·1 ,,
,, 2 ,,	83·3	16·6 ,,

With due allowance for the very small numbers this list shows an almost regular rise in the relative proportion of multiple cases with the increase in the number of inmates of the infected households.

Another line of comparison between the members of the invaded community and those of them who were attacked with small-pox may be made as regards the ages and occupations of each group, in order to ascertain whether there was a disproportionate incidence at any age-period, or in any of the three main "occupation-series."

With respect to *age*, the first of the two following tables gives in an extended form the figures which are condensed in the second of them.

—	Inmates.	Cases.	Per-centage of Cases at Age-Periods.
Under 1 year - -	9	4	44·4 (Under 1 year.)
1 to 5 years - -	59	21	
5 to 10 ,, - -	105	36	
	164	57	34·7 (1 to 10 years.)
10 to 15 years - -	97	25	
15–20 ,, - - -	101	42	
20–30 ,, - - -	100	37	
	298	104	34· (10–30 years.)
30–40 years - - -	87	31	
40–50 ,, - - -	83	15	
50–60 ,, - - -	47	3	
60–70 ,, - - -	21	2	
70 and over - - -	5	1	
	243	52	21·4 (30 years & over.)
Age not ascertained -	2	—	
	716	217	30·3 (All ages.)

And stated in per-centages of the total numbers the comparisons between those exposed to infection and those attacked at the different age-periods is—

—	Inmates.	Cases.
Under 1 Year - -	1·2 per cent.	1·8 per cent.
1 to 10 years - -	22·8 ,,	26·2 ,,
10 to 30 years - -	41·6 ,,	47·9 ,,
30 years and upwards -	33·9 ,,	24·0 ,,

Occupation.—A comparison may also be made between the three classes of occupations in which the patients and their relatives may be grouped, and for this purpose the accompanying Chart (XIII.) has been drawn to indicate the class into which each member of an infected household falls.

TABLE LIX.

Occupations of Members of Infected Households.

Reference to House.	Register.	All Inmates.			Attacked with Small-pox.*		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
Back Lawson Street	2	1		1			105
Thornhill Road -	34	1		1	28		
Denton's Yard, George Street.	83			2			139
Lacey Street, Boothroyd Lane.	96			2			267
Whitley Street .	104	1		1	**231**		
Back Lawson Street	132			2			203–204
Back Cliffe Street -	5			3			111
Kensington Street	13	1		2			70
Thornhill Road -	20	1	1	1	61		
Thornhill Road -	21			3			161
Thornhill Road -	39	1		2			59
School Lane -	48	1		2			35
Scout Hill - -	50	1		2			149

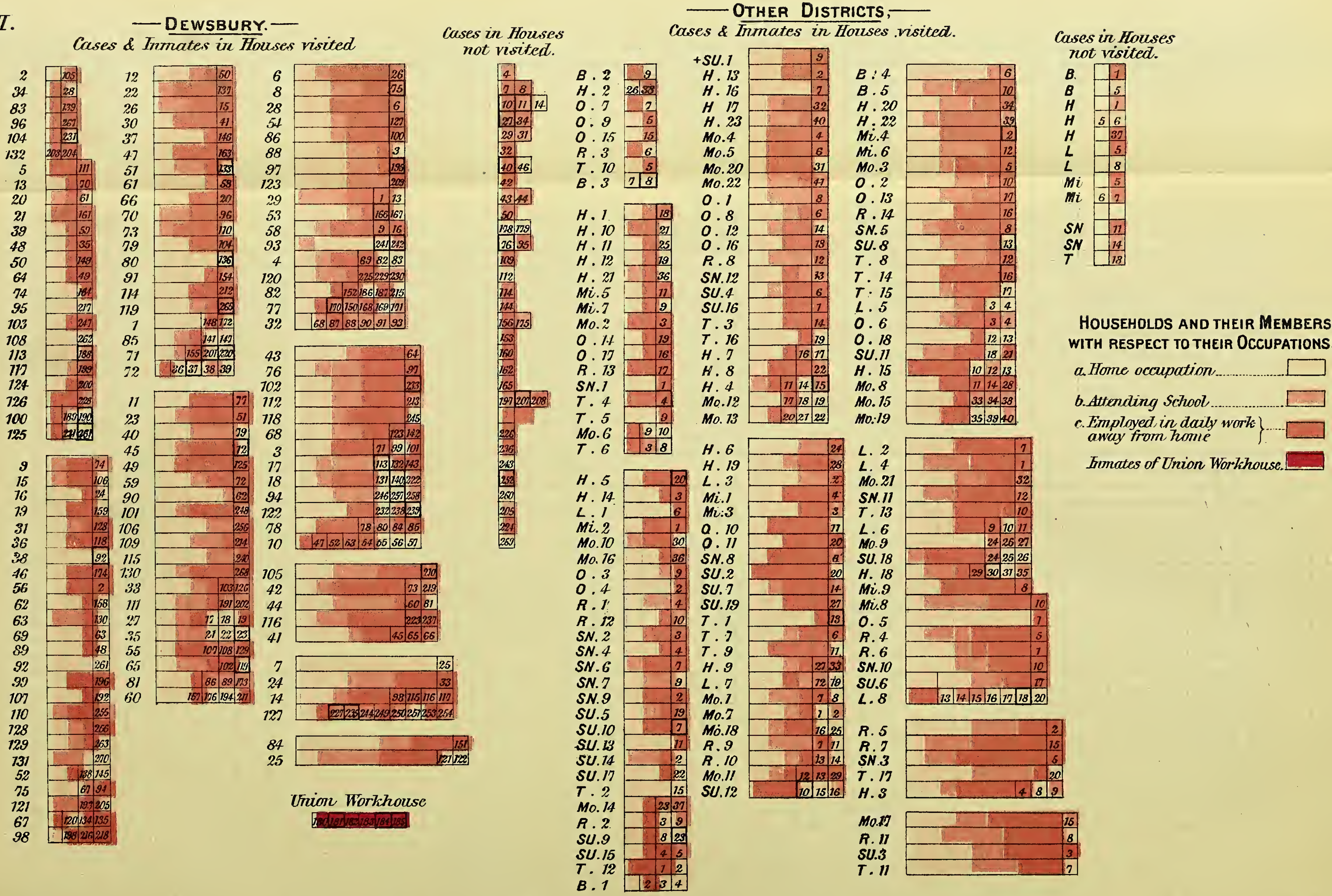
* The numerals refer to Case Register.

Small-pox at Dewsbury, 1891–2.

Reference to House.	Register.	All Inmates.			Attacked with Small-pox.		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
David Lane	64	1		2			49
Ashworth Road	74	2		1			164
High Street	95	3			217		
Whitley Street	105	1		2			247
Wellington Road	108	3			262		
Ingham Stree	113	2	1			**188**	
Calder Bank Terrace.	117	1	1	1			199
Bradford Road	124	1	1	1		200	
Upper Camroyd Street.	126		1	2		228	
George Street	100	2		1	189, **190**		
Lawson Stree	125	2		1	221, **264**		
Vulcan Road	9		2	2		74	
Back Kensington Street.	15	1	1	2	106		
Huddersfield Road	16	3		1	24		
Fall Lane	19	2		2	159		
Halliley Street	31	1	1	2			128
Fall Lane	36	1		3			118
Thornhill Road	38	4			**92**		
Nowell Hill Road	46	1		3			174
Back Leatham Street.	56	1		3			2
Moor End Lane	62	3		1	158		
Naylor's Fold, Batley Carr.	63	1	2	1	130		
Upper Road	69	3		1	63		
Longlands	89	3		1	48		
Huddersfield Road	92	4			261		
Central Street	99	1		3			196
Longcauseway	107	3		1	192		
New Street	110		2	2		255	
Fall Lane	128	1	1	2			266
Thornton Street	129	2	1	1	263		
Swallow Road, Daw Green.	131	2	2		270		
Gladstone Street	52	3		1	138, 145		
Cossham Street	75	2	1	1		67	94
Staincliffe Road	121	1	2	1	205		193
Thomas Street	67	1		3	120		134, 135
Cossham Street	98	1		3			198, 216 218
Thornton Street	12	2	2	1		30	
High Street	22		1	4			37
Back Hanover Street.	26		2	3			15
Lacey Street	30	1		4			41
Whitehead Buildings.	37	3		2			146
Wroe Street, Dewsbury Moor.	47	1		4			163
Princes Street	51	2	2	1	**133**		
Brewerton Lane	61	3	1	1			58
Carlisle Street	66	2		3			20
Upper Road	70		2	3			96
Quarry Road	73	1	1	3	110		
Scout Hill	79	2		3			104
Burgh Mill Lane	80	5			**136**		
Back Cliffe Street	91	3	1	1		154	
Middle Road	114	2		3			212
Calder Back Terrace.	119	2	2	1		**265**	
Lawson Street	1	4		1	172		148
Cemetery Road	85	3	1	1	141, 147		
Longcauseway	71	3	1	1	**201, 220**		155
Quarry Road	72	3	1	1	36, **37**, 39	38	
Tweedale Street	11	2		4			77

Reference to House.	Register.	All Inmates.			Attacked with Small-pox.		
		At Home.	At School.	At Work	At Home	At School.	At Work.
Wilman's Yard, High Street.	23	1	1	4			51
High Street	40	3	3		79		
Nowell Hill Road	45	2	1	3	**12**		
Scout Hill	49	1		5			125
Nowell Hill Road	59	2	1	3			72
Victoria Crescent	90	4	1	1			**62**
Thornton Street	101	1	2	3		248	
Oates Street	106	3	2	1			256
Pit Street	109	2	2	2			214
Thornhill Road	115	3	2	1			240
Back Belgrave Street.	130	1	1	4			268
Huddersfield Road	33	2	2	2		126	103
Whitworth Road	111	1	4	1		191, 202	
Whitley Street	27	3	1	2	17, 18		19
Thornhill Road	35	4	2		21, 22, **23**		
Back Gladstone Street.	55	1	2	3		107, 108	129
Smith Road, Batley Carr.	65	2	2	2	**119**		102
Ernest Jones Street	81	2	3	1		86, 89, 173	
Staincliffe Road	60	4		2	176, 194		157, 211
Cliffe Street	6	1	2	4		26	
Vulcan Road	8	2	3	2		**75**	
Whitley Street	28	2	1	4		6	
Gladstone Street	54	2	1	4			127
Cemetery Road	86	2	1	4			100
Staincliffe Road	88	4	2	1	3		
Ashworth Road	97	3	2	2			**195**
Smith Road	123	3	3	1			209
Back Whitley Street	29	1	3	3	13		1
Gladstone Street	53	4	1	2	167		**166**
Nowell Hill Road	58	1	1	5			9, 16
Huddersfield Road	93	5	2		**241**	242	
Elizabeth Terrace, Woodville.	4	3	1	3	82, 83		69
Fall Lane	120	1	4	2		229, 230	225
Central Street	82	4		3	186, 215		152, 187
Scout Hill	77	2	3	2	169	150, **170** 171	168
S. Woodbine Street	32	1	5	1		68, 88, 90, 91, 93	87
Back New Street	43	3	2	3		64	
Scout Hill	76	1	3	4			97
Oastler Street	102	2	2	4			**233**
Senior Street	112	2	3	3		213	
Calder Bank	118	3	1	4	245		
Naylor Street, Batley Carr.	68	2	2	4			123, 142
Elizabeth Terrace	3	3		5	99		71, 101
Fall Lane	17	2	4	2	**113**		132, 143
Fall Lane	18	3	2	3	131, **140**	222	
Huddersfield Road	94	4	4		246, **257**	258	
Wood Hill	122	5	1	2	232, **239**	238	
Scout Hill	78	1	1	6		80	78, 84, 85
Vulcan Road	10	3		5	55, 56, 57		47, 52, 53, 54.
Hanover Street	105	2	3	4			**210**
Bowling's Fold, High Street.	42	1	3	5		73, 219	
Back New Street	44	3	4	2	81		60
West Vale	116	1	2	6			223, 237
Curry Fold	41	3	2	4		**66**	45, 65
Westgate	7	10			25		

Chart XIII.



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Houses in Dewsbury & other Districts of the Union
Number and Occupations of Inmates.

4292·1·94.

Reference to House.	Register.	All Inmates.			Attacked with Small-pox.		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
Middle Street	24	3	3	4			33
Kensington Street	14	2	2	6		116	98, 115, 117
Caxton Square	127	2	5	3	251	**227**, **235**, 244, 250, 254	249, 253
Boothroyd Lane	84	5	2	4			151
Manor Road	25	3	4	4	121, 122		
Summary.							
130 Houses visited		267	159	290	72	48	97
29 Houses not visited.	*See* appended list.				8	9	24
					80	57	121
Infirmary					1		
Workhouse	Not in list. 6 cases.						

The following is a list of the infected houses which were not visited, so that the particulars are limited to those of the inmates who were attacked with small-pox :—

——	At Home.	At School.	At Work.
Whitley Street		4	
Boothroyd Lane			7, 8
Scout Hill Road	14	**11**	**10**
Leeds Road			**27**, 34
Dewsbury Moor		29, 31	
Commercial Street			32
Heckmondwike Road	46		**40**
Horsfield Street, Batley Carr			42
Back Leatham Street		43	44
Newlands			50
—— Lane	178, 179		
Fall Lane	**76**		95
Bradford Road			109
The Infirmary	112		
Kiln Road			114
G—— L—— Inn			144
Middle Road		175	156
George Street			153
George Street			160
Dewsbury Moor			162
South Woodbine Street			165
Asylum Road		197, **207**	208
Whitworth Road		205	
Back Whitley Street			224
Bradford Road			226
Thornton Street			236
Burgh Mill Farm	243		
Tweedale Street			**252**
Back Fearnley Street	260		
High Street	269		

Explanation of Chart XIII. :—

In this chart, as in Chart VII., an attempt is made to represent graphically the occupation of the inmates of houses, of which particulars were obtained. It contains in all 277 houses, viz., 130 in Dewsbury and 147 in other districts (excluding Batley) of the Union.

As in Charts IV., VI., and VII., the population is divided into three groups: (1) those at home; *(2) those attending school; and (3) those engaged in daily* work *away from home.*

The houses are arranged in consecutive series, according to the number of their inmates, and the numerals prefixed to them indicate the reference to the "House Register" compiled in the inquiry. The figures printed upon the square areas (each of which denotes one individual) are those of the "Case List" of small-pox cases.

The "Other districts" comprise :—

Birstal (B), Heckmondwike (H), Liversedge (L), Mirfield (Mi), Morley (Mo), Ossett (O), Ravensthorpe (R), Soothill Nether (SN), Soothill Upper (SU), Thornhill (T).

The details are to be found in Tables LIX. and LXXVI.

N.B.—The fatal cases are denoted by a thick-lined border.

Small-pox at Dewsbury, 1891-2.

Thus :—

Of the 716 persons inhabiting 130 houses invaded by small-pox there were—

267 living at home or engaged in home occupations.
159 attending school.
290 engaged in daily work away from home.

Comparison as to occupation of the inmates of infected houses.

The number of cases of small-pox in these houses comprised—

72 living at home, or about 27 per cent.
48 attending school, or about 30 per cent.
97 engaged in outside work, or about 33 per cent.

The same numbers analysed according to the *size* of the households give :—

TABLE LX.

Number of Inmates per House.	Number of Houses.	Total Inmates.			Total Cases.		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
11	2	8	6	8	2		1
10	4	17	10	13	2	6	6
9	5	10	14	21	1	3	6
8	13	34	25	45	12	6	15
7	17	41	35	43	9	14	14
6	20	44	32	44	10	9	15
5	20	42	17	41	1	4	12
4	25	45	15	40	16	3	13
3	18	23	5	26	7	3	10
2	6	3		9	2		5
	130	267	159	290	72	48	97

It is a question of some interest to determine whether any difference existed in the class of persons primarily attacked with small-pox in a family and those who were subsequently (and for the most part secondarily) attacked. In an industrial community such as this, the chances of infection at the places of work might, one would think, lead to a greater proportion of those primarily attacked being engaged in work away from home. Such individuals might introduce the disease into their families, and therefore the divergence between the classes might not be so great amongst the later occurring cases than amongst the "initial" cases. Similarly the influence of schools as centres of infection might *à priori* find expression in a greater morbidity among this class of "initial" cases, than among the later cases. It will be seen, however, from the analysis given below that although the proclivity to attack was about equal in those remaining "at home" and those attending "school," the relative incidence was much less in the latter class.

SINGLE CASES IN HOUSE.

Occupation.	All Inmates.		Attacked and sent to Hospital.	Not Attacked.
	Attacked and kept at Home.	Not Attacked.		
86 houses visited :				
At home	1	6	24	132
At school	—	2	14	65
At work	2	3	45	132
20 houses not visited :				
At home			4	
At school			2	
At work			14	

Small-pox at Dewsbury, 1891-2.

MULTIPLE CASES in HOUSES.

Occupation.	Attacked, and kept at Home.		Not attacked.	Attacked and sent to Hospital.		Not attacked.
	Initial.	Later.		Initial.	Later.	
At home - -	—	—	—	21	26	57
At school - -	—	—	—	13	21	44
At work - -	—	—	—	24	26	58
At home - -	1	1	—	1	2	
At school - -	—	—	—	5	2	
At work - -	—	—	—	4	4	

From this summary one may calculate the "attacks rates" among those households of which particulars were obtained :—

Occupation.	Cases kept at Home.		Cases sent to Hospital.	
	Single.	Multiple (exclusive of Initial Cases.)	Single.	Multiple (exclusive of Initial Cases.)
At home - -	Per cent. 14·2	—	Per cent. 15·3	Per cent. 31·4
At school - -	—	—	17·7	32·3
At work - -	40·0	—	25·4	30·9

From which it appears that a greater proportion of those engaged "at work" suffered primarily, but that the proclivity was about equal in all three classes among those attacked subsequent to the introduction of the disease into the household.

Lastly, the relative proportion of each class of all attacked shows a marked preponderance of the "workers" in those where only single cases occurred in a house, thus :—

——	Single Cases.	Multiple (Initial).	Multiple (Later).
	Per cent.	Per cent.	Per cent.
At home - -	29 cases or 27·3	23 cases or 33·3	29 cases or 35·3
At school - -	16 „ 15·1	18 „ 26·1	23 „ 28·
At work - -	61 „ 57·5	28 „ 40·5	30 „ 36·6

Vaccination data.

Of the 265 patients at Dewsbury there were—

(A.) Vaccinated - - -	135,	of whom 5	died.
(B.) Alleged to have been vaccinated but presenting no marks -	6	„ 1	„
(C.) Undergoing primary vaccination when attacked with small-pox - - -	5	„ 1	„
(D.) Unvaccinated - -	119	„ 32	„

The mortality in each of these classes was therefore—

A. Vaccinated - -	3·7	per cent.
B. Alleged vaccination -	16·6	„
C. Under vaccination -	20·	„
D. Unvaccinated - -	26·9	„

In the accompanying table and diagram (Chart XIV.) the incidence of these respective classes of subjects are illustrated; and it will be seen that they maintained fairly the same proportions to one another throughout the epidemic. (*See also* Chart X.)

TABLE LXI.

DEWSBURY.—SMALL-POX, 1891-92.

Weekly Distribution of Cases according to Vaccination—Relations (Chart XIV.*).

No. of Week of Outbreak.	Vaccinated.		"Alleged" Vaccination.		"Under" Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	C.	D.
viii.	1						1		2	
ix.	1						1	1	2	1
x.	2						1		3	
xi.	1						2	1	3	1
xii.			1				1		2	
xiii.	1						2	1	3	1
xiv.	—									
xv.	1								1	
xvi.	1						1	1	2	1
xvii.	1	1					1	1	2	2
xviii.	1						1		2	
xix.	2						1		3	
xx.	1								1	
xxi.	1								1	
xxii.	1								1	
xxiii.	—						1		1	
xxiv.	—									
xxv.	—						1	1	1	1
xxvi.	2						2		4	
xxvii.	—									
xxviii.	—						2	1	2	1
xxix.	—						1		1	
xxx.	1						1	1	2	1
xxxi.	—									
xxxii.	—						2		2	
. . .									. . .	. . .
xxxv.	2								2	
xxxvi.							2	2	2	2
xxxvii.	1						5		6	
xxxviii.	1						1		2	
xxxix.	3						2		5	
xl.	5						3		8	
xli.	4	1					3		7	1
xlii.	6						4	2	10	2
xliii.	1		2		2		7	1	12	1
xliv.	8						5	1	13	1
xlv.	8						1		9	
xlvi.	4		2	1			3		9	1
xlvii.	7						3	1	10	1
xlviii.	1		1				3		5	
xlix.	5						2	1	7	1
l.	4						3	1	7	1
li.	9				1		3		13	
lii.	7						2	1	9	1
liii.	7				1		6	3	14	3
liv.	5	2					2		7	2
lv.	2						2		4	
lvi.	4						6	2	10	2
lvii.	5						5	1	10	1

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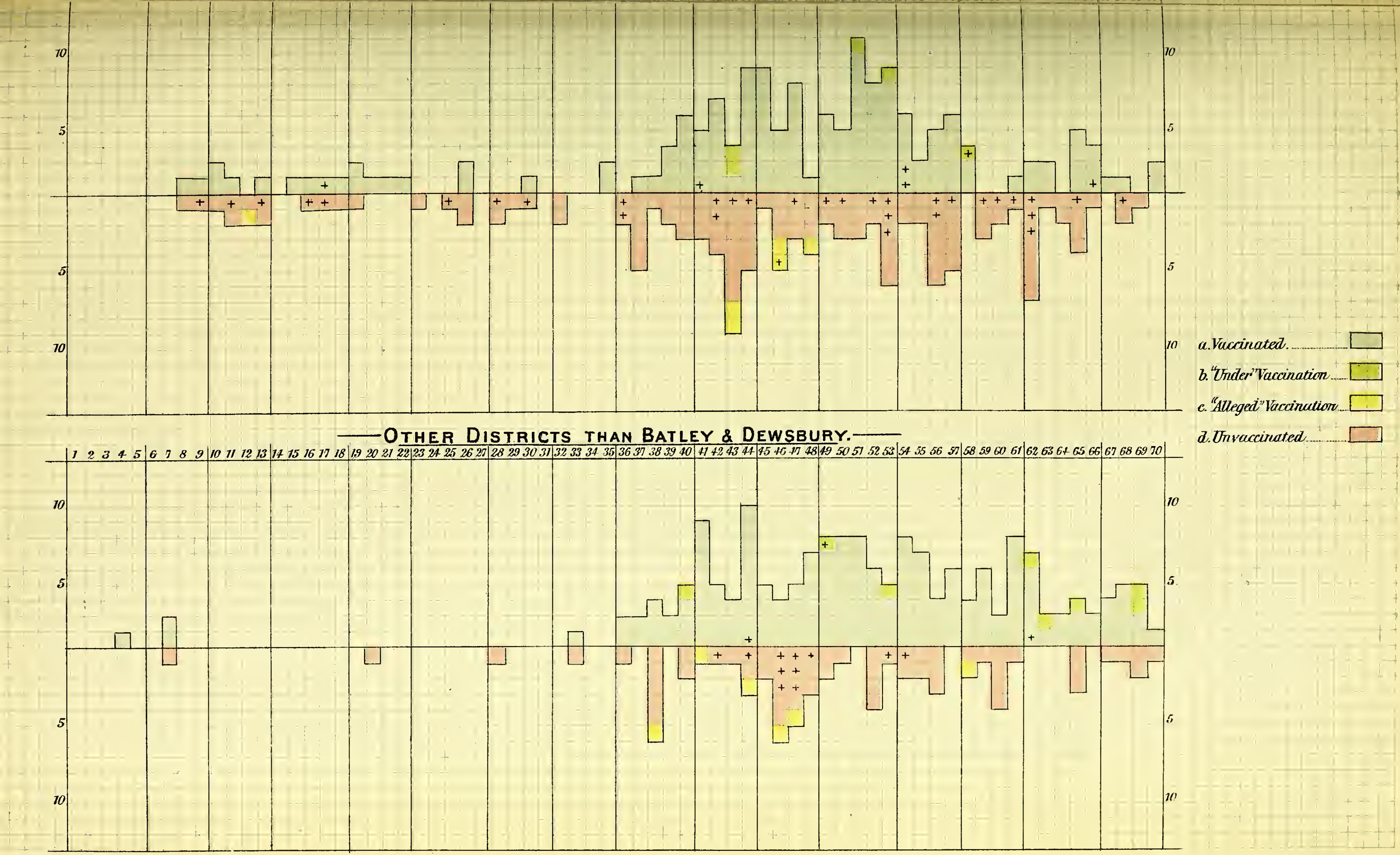
* *Explanation of Chart XIV. :—*
This Chart is drawn on the same principle as Chart IX., and represents the weekly incidence of small-pox in Dewsbury, and also in the other districts (except Batley and Dewsbury) which were invaded; the condition of each of the patients as regards vaccination is indicated as in that and other Charts.

10
5
5
10
OTHER DISTRICTS THAN BATLEY & DEWSBURY.
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70
10
5
5
10
a. Vaccinated.
b. "Under" Vaccination
c. "Alleged" Vaccination
d. Unvaccinated

face page 80.

Table LXI—*continued.*

No. of Week of Out-break.	Vaccinated.		"Alleged" Vaccination.		"Under" Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	C.	D.
lviii.	2					1			3	1
lix.							3	1	3	1
lx.							2	1	2	1
lxi.	1						1	1	2	1
lxii.	2						7	3	9	3
lxiii.	2						1		3	
lxiv.							2		2	
lxv.	4						4	1	8	1
lxvi.	3	1					1		4	1
lxvii.	1								1	
lxviii.	1						2	1	3	1
lxix.							1		1	
lxx.	2								2	
	135	5	6	1	5	1	119	32	265	39

ion.

On examining the relation between the state as to vaccination and the *ages* of the subjects, it is seen that about one half of the unvaccinated class were under the age of 10 years, and about ⅘ths under 15 years. The following is a detailed statement:—

TABLE LXII.

—	Vaccinated.		Alleged Vaccination.		Under Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year -					2	1	4	3	6	4
1 to 5 - -	2				2		17	8	21	8
5 „ 10 - -	3				1		36	8	40	8
10 „ 15 - -	12		1				18	1	31	1
15 „ 20 - -	24		4				21	1	49	1
20 „ 30 - -	39	1					16	7	55	8
30 „ 40 - -	31	3					3	1	34	4
40 „ 50 - -	14	1	1	1			4	3	19	5
50 „ 60 - -	4								4	
60 „ 70 - -	2								2	
70 and over -	1								1	
Age not ascertained -	3								3	
Total -	135	5	6	1	5	1	119	32	265	39

which may be grouped in age-periods as—

—	Under 1 year.		1 to 10 years.		10 to 30 years.		30 and over.		Age not ascertained.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Vaccinated -			5	—	75	1	52	4	3	—
Alleged vaccination.					5	—	1	1		
Under vaccination.	2	1	3	—						
Unvaccinated -	4	3	53	16	55	9	7	4		
Total - -	6	4	61	16	135	10	60	9	3	—

Small-pox at Dewsbury, 1891-2.

or stated in per-centages :—

Of the *vaccinated*—

3·7 per cent. were at ages 1 to 10 years.
55·5 „ „ 10 „ 30 „
38·5 „ „ 30 and over.

Of the *unvaccinated*—

3·3 per cent. were under 1 year of age.
41·5 „ at ages 1 to 10 years.
46·2 „ „ 10 „ 30 „
5·9 „ „ 30 years and upwards.

On the other hand, at the age-period of—

Under 1 year - -	None were vaccinated.	66·6 per cent. unvaccinated.
1 to 10 years - -	8·3 per cent. were vaccinated.	86·9 per cent. unvaccinated.
10 „ 30 „ - -	55·1 per cent. were vaccinated.	40·7 per cent. unvaccinated.
30 and upwards -	86·6 per cent. were vaccinated.	11·6 per cent. unvaccinated.

Turning now to consider the question of vaccination in relation, not merely to the mortality from small-pox, but to the *type* of the attacks, the cases may be divided in the following manner (*see* Chart XI.):—

TABLE LXIII.

—	Confluent.	Coherent.	Discrete.	Mild.	Type undetermined.
Vaccinated -	19	11	40	63	2
Alleged vaccination.	3	1	1	1	
Under vaccination	2	1		1	1
Unvaccinated -	81	19	17	2	

or, in other words, at all ages—

(*a.*) Among the *vaccinated:* 13·3 per cent. had confluent small-pox; 8·1 per cent. coherent; 29·6 per cent. discrete; 46·6 per cent. mild.

(*b.*) Among the *unvaccinated:* 68 per cent. had confluent small-pox; 16 per cent. coherent; 14·3 per cent. discrete; 1·6 per cent. mild;

and conversely—

(*a.*) Of *confluent* cases: 18 per cent. were vaccinated; 77 per cent. were unvaccinated.

(*b.*) Of *coherent* cases: 34·4 per cent. were vaccinated; 59·4 per cent. were unvaccinated.

(*c.*) Of *discrete* cases: 69 per cent. were vaccinated; 29·3 per cent. were unvaccinated.

(*d.*) Of *mild* cases: 94 per cent. were vaccinated; 3 per cent. were unvaccinated.

It remains to contrast the condition *quâ* vaccination of the occupants of houses invaded with small-pox with that of those attacked with the disease.

At all ages there were of 716 inmates (of 130 houses)—

496 vaccinated, or 69·2 per cent.,
14 "alleged" vaccinated,
11 "under" vaccination,
168 unvaccinated, or 23·4 per cent.,

and in 27 instances no information was obtainable, whilst of the same households, amongst the 217 cases of small-pox—

113 were vaccinated, or 52 per cent.
5 "alleged" vaccinated.
5 "under" vaccination.
94 unvaccinated, or 43·3 per cent.

Small-pox at Dewsbury, 1891-2.

At each age-period the numbers of each class are :—

	Vaccinated.	Alleged Vaccination.	"Under" Vaccination.	Unvaccinated.	No Information.
At under one year					
Inmate	2	—	2	5	—
Cases	—	—	2	2	—
1 to 10 years					
Inmates	73	2	9	80	—
Cases	5	—	3	49	—
10 to 30 years					
Inmates	214	5	—	71	8
Cases	61	4	—	39	—
30 years and over :					
Inmates	207	7	—	12	17
Cases	47	1	—	4	—
Age not ascertained :					
Inmates	—	—		—	2

Assuming that these individuals were equally exposed to the chances of infection, a postulate which has of course no basis in fact, these figures show—

1st. That of the *vaccinated* class, the proclivity to the disease was :—1 : 14·6 of the exposed between 1 and 10 years of age ; 1 : 3·5 between 10 and 30 ; and 1 : 4·4 over 30 years.

2nd. That of the *unvaccinated* class the proclivity was 1 : 1·7 between 1 and 10 years ; 1 : 1·8 between 10 and 30 years ; and 1 : 3·0 at 30 years and over.

3rd. As regards the classes of "alleged" and "under" vaccination, it may be remarked that 1 in 3 of the former and 1 in 1·8 of the latter contracted the disease.

4th. The number of infants below one year of age is too small to make any useful deduction. The two vaccinated children in infected houses escaped the disease, and so did three out of five of the unvaccinated. Two others were unvaccinated, but were vaccinated whilst incubating small-pox ; one of them, a new-born infant (No. 264), died.

Previous small-pox.

Previous attack of small-pox.—The foregoing considerations require to be modified in view of the previous occurrence of small-pox in some of the individuals concerned.

The number thus protected amounts to 26, only four of whom were under 30 years of age. Of them, 18 belonged to the vaccinated class ; and five to the unvaccinated, in one vaccination was alleged, but had left no evidence, and in two no information as to vaccination could be obtained. The only striking difference arising from subtracting those cases is in respect to the "unvaccinated" class at 30 years and over ; for of the 12 inmates 3 had had small-pox, raising the proclivity from 1 in 3 to 1 in 2·5.

The full data upon which the preceding calculations have been made are to be found in the annexed table and Chart XV.

TABLE LXIV.

TABLE giving VACCINATION DATA of the members of Infected Households and those attacked with Small-pox (Chart XV*.).

Reference to House List.	All Inmates.					Attacked with Small-pox.			
	Vaccinated.	No information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
2	1				1				105
34	1	1				28			
83	2					139			
96	2					267			
104	1				1				**231**
132	1				1	204			203
5	2			1				111	
13	2			1		70			
20	2				1	61			
21	2				1				161
39	1				2				59
48	3					35			
50	3					149			
64		1			2				49
74	3					164			
95	3					217			
103	1				2				247
108	3					262			
113	2				1				**188**
117	3					199			
124	1	1			1				200
126	3					228			
100	2				1	189			**190**
125	2		1			221	**264**		
9	2				2				74
15	3				1	106			
16	4					24			
19	4					159			
31	2				2				128
36	2	1				118			
38	2			1	1				**92**
46	3			1		174			
56	3				1	2			
62	2				2	158			
63	4					130			
69	3				1	63			
89	4					48			
92	4					261			
99	2				2	196			
107	2				2				192
110		1			3				255
128		3			1				266
129	3				1	263			
131	4					270			

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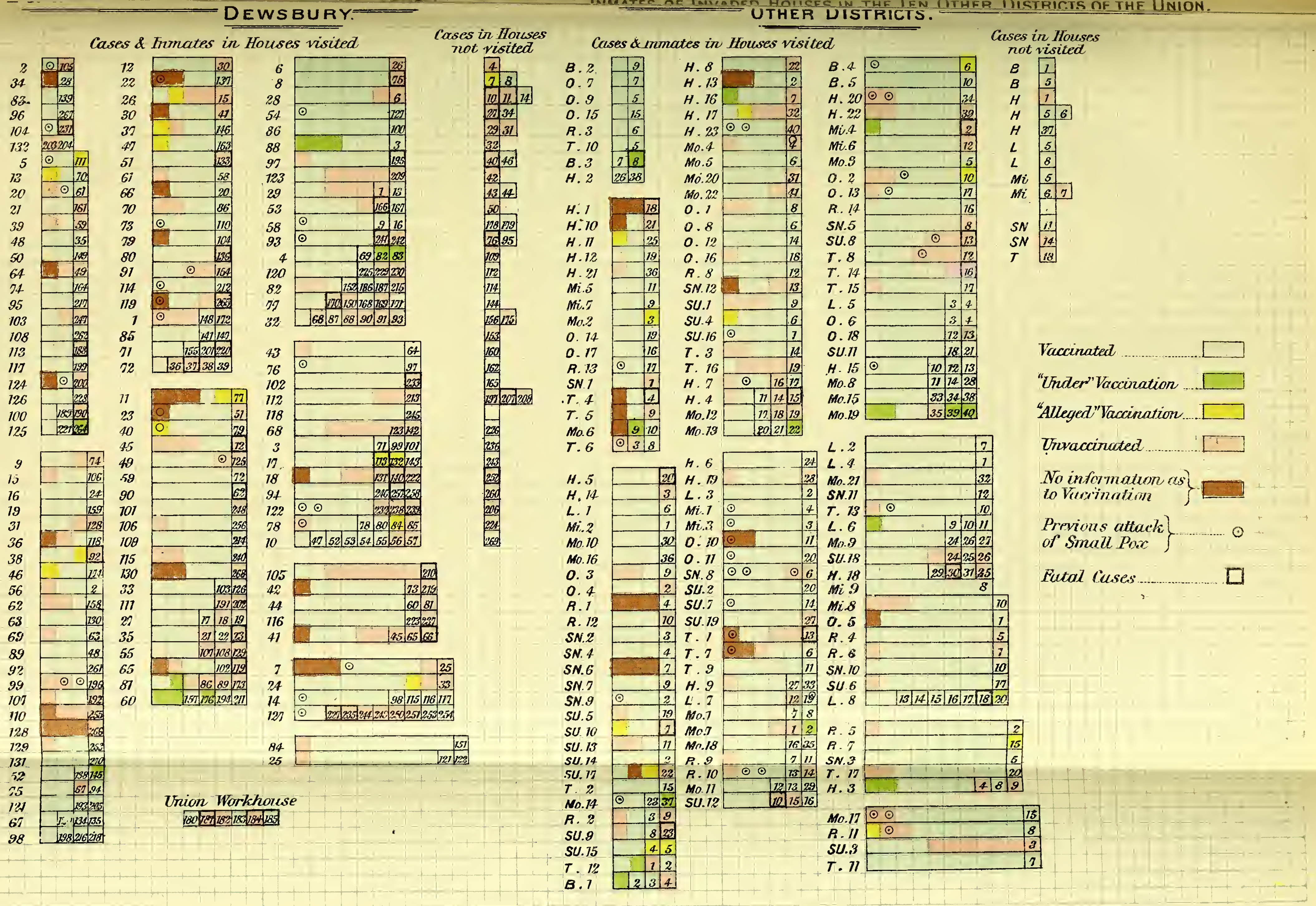
* *Explanation of Chart XV.:—*
This Chart is drawn up on precisely the same plan as Chart X., and represents each of the 277 houses in Dewsbury and other districts (exclusive of Batley) concerning whose inmates particulars were obtained.
The Chart is coloured to show the vaccination conditions of each inmate, and the tints employed are the same as those in Chart IX.
A previous attack of small-pox is denoted by the sign ⊙ in the case of those who did not suffer in this outbreak. In two cases the attack was said to have been the second one experienced by the patient, viz., Mo. 4 (case 4), and L. 2 (case 19).

Chart XV.



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Small-pox at Dewsbury 1891-2.

Table LXIV—*continued.*

Reference to House List.	All Inmates.					Attacked with Small-pox.			
	Vaccinated.	No information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
52	3		1			138	145		
75	3				1	94			67
121	4					193, 205			
67	4					120, 134, 135			
98	4					198, 216, 218			
12	4				1				30
22	3	2				137			
26	1			1	3				15
30	3	1			1				41
37	3			1	1	146			
47	4			1		163			
51	4				1				**133**
61	4				1	58			
66	4	1				20			
70	3				2	96			
73	5					110			
79	4	1				104			
80	4				1				**136**
91	2				3				154
114	5					212			
119	2	1			2				**265**
1	1				4	148			172
85	5					141, 147			
71	4				1	155, **201**			**220**
72	2				3	39			36, **37**, 38
11	1	3		2				77	
23	4	1			1				51
40	5			1		79			
45	2				4				**12**
49	4				2				125
59	6					72			
90	6					**62**			
101	5				1				248
106	5				1	256			
109	6					214			
115	4				2	240			
130	3	2			1				268
33	6					103, 126			
111	4				2				191. 202
27	5				1	17, 19			18
35	4				2	22			21, **23**
55	3				3				107, 108, 129
65	3	1			2	102			**119**
81	1		1		4				86, 89, 173
60	3		3			157, 194, 211	176		
6	6				1				26
8	6				1				**75**
28	5				2				6
54	7					127			
86	7					100			
88	4		3			3			
97	6				1	**195**			
123	2				5				209
29	3				4	13			1

Table LXIV—*continued.*

Reference to House List.	All Inmates.					Attacked with Small-pox.			
	Vaccinated.	No information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
53	5				2	167			**166**
58	7					9, 16			
93	5				2				**241** 242
4	5		2			69	82, 83		
120	5				2	225			229 230
82	4				3	152, 186, 187			215
77	4				3	168, 171			150, 169, **170**
32	2				5	87			68, 88 90, 91, 93
43	7				1	64			
76	8					97			
102	7				1				**233**
112	5				3				212
118	8					245			213
68	2				6				123 142
3	8					71, 99, 101			
17	6			2		143		**113**, 132	
18	2	1			5				131, **140** 222.
94	8					246, **257**, 258			
122	5				3				232, 238, **239**
78	5			1	2	78, 80		84	85
10	6				2	47, 52, 53, 54, 55			56, 57
105	2				7				**210**
42	6	1			2				73, 219
44	7				2	60			81
116	8				1	223			237
41	3	1			5				45, 65, **66**
7	5	3			2				25
24	7			1	2				33
14	10					98, 115, 116, 117			
127	4				6	253, 254			**227** **235** 244, 249, 250, 251
84	10				1	151			
25	10				1	121, 122			
Summary. 130 Houses	496	27	11	14	168	113	5	5	94
29 Houses not visited (*see* appended list) -						19		1	22
Workhouse inmates (not in list) -						3			3
						135	5	6	119

Small-pox at Dewsbury, 1891-2.

SUPPLEMENTAL LIST, giving Vaccination Data of those attacked with Small-pox in houses of which no further particulars were obtained.

Vaccinated.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	——
			4	Whitley Street.
8		7		Boothroyd Lane.
14			**10, 11**	Scout Hill Road.
84			**27**	Leeds Road.
			29, 31	Dewsbury Moor.
			32	Commercial Street.
46			**40**	Heckmondwike Road.
			42	Horsfield Street.
4			43	Back Leatham Street.
			50	Newlands
7 179				—— Lane.
95			**76**	Fall Lane.
			109	Bradford Road.
112				The Infirmary.
114				Kiln Road.
144				G—— L—— Inn.
156			175	Middle Road.
			153	George Street.
160				George Street.
162				Dewsbury Moor.
165				South Woodbine Street.
			97, **207,** 208	Asylum Road.
			206	Whitworth Road.
			224	Back Whitley Street.
226				Bradford Road.
236				Thornton Street.
243				Burgh Mill Farm.
			252	Tyndale Street.
			260	Back Fearnley Street.
269				High Street.

Influence of vaccination in spread of disease.

The question as to how far the vaccination conditions of the members of a family influenced the occurrence of multiple cases in a household may be studied from the lists previously given, and the facts arising therefrom may be summarised as follows :—

GROUP A.—CASES REMOVED TO HOSPITAL.

(*a.*)—Households having a single case (83 in number).

—	Numbers Attacked.	Numbers not Attacked.
Vaccinated - - - - - -	46	243*
Re-vaccinated before house infected -	1	2
Re-vaccinated on or after „ -	—	6
Had small-pox previously - -	—	11
Under vaccination - - -	0	3
Alleged vaccination - -	2	8
Had small-pox previously - -	—	1
No information on vaccination - -	0	23
Had small-pox previously - -		3
Unvaccinated - - - - -	35	52
Had small-pox previously - -		3
	83	329
Re-vaccinated - - -		8
Previous small-pox - - -		18

* 1 "inoculated,"

(*b.*)—Households having multiple cases (44 houses).

—	Attacked.		Not Attacked.
	Initial Case.	Later Case.	
Vaccinated - - - -	28	36	130*
Re-vaccinated before house infected.	—	1	5
Re-vaccinated on or after house infected.	—	—	6
Had small-pox previously -			6
Under vaccination - -	3	2	3
Alleged vaccination - -	2	1	0
No information on vaccination -	0	0	4
Unvaccinated - - - -	25	34	22
Had small-pox previously -			2
	58	73	159
Re-vaccinated - -			11
Had small-pox previously -			8

* 6 "inoculated."

GROUP B.—CASES TREATED at HOME.

Single cases in households.

——	Attacked.	Not Attacked.
Vaccinated - - - - - -	3	10*
Re-vaccinated before house infected -	—	1
Re-vaccinated on or after „ -	—	3
Alleged vaccination - - - -	0	1
	3	11
Re-vaccinated - - - -		4

* 2 "inoculated."

And in the only instance of a family where more than one case of small-pox occurred and not removed to hospital, both the "initial" and the "later" cases (178 and 179) were vaccinated. Particulars of those in this house who were not attacked are wanting.

From these figures one may calculate the "attack-rates" amongst the vaccinated and unvaccinated classes respectively :—

(*a.*) Of small-pox in families having a single case;

(*b.*) Of the cases arising in families subsequent to removal of the initial cases.

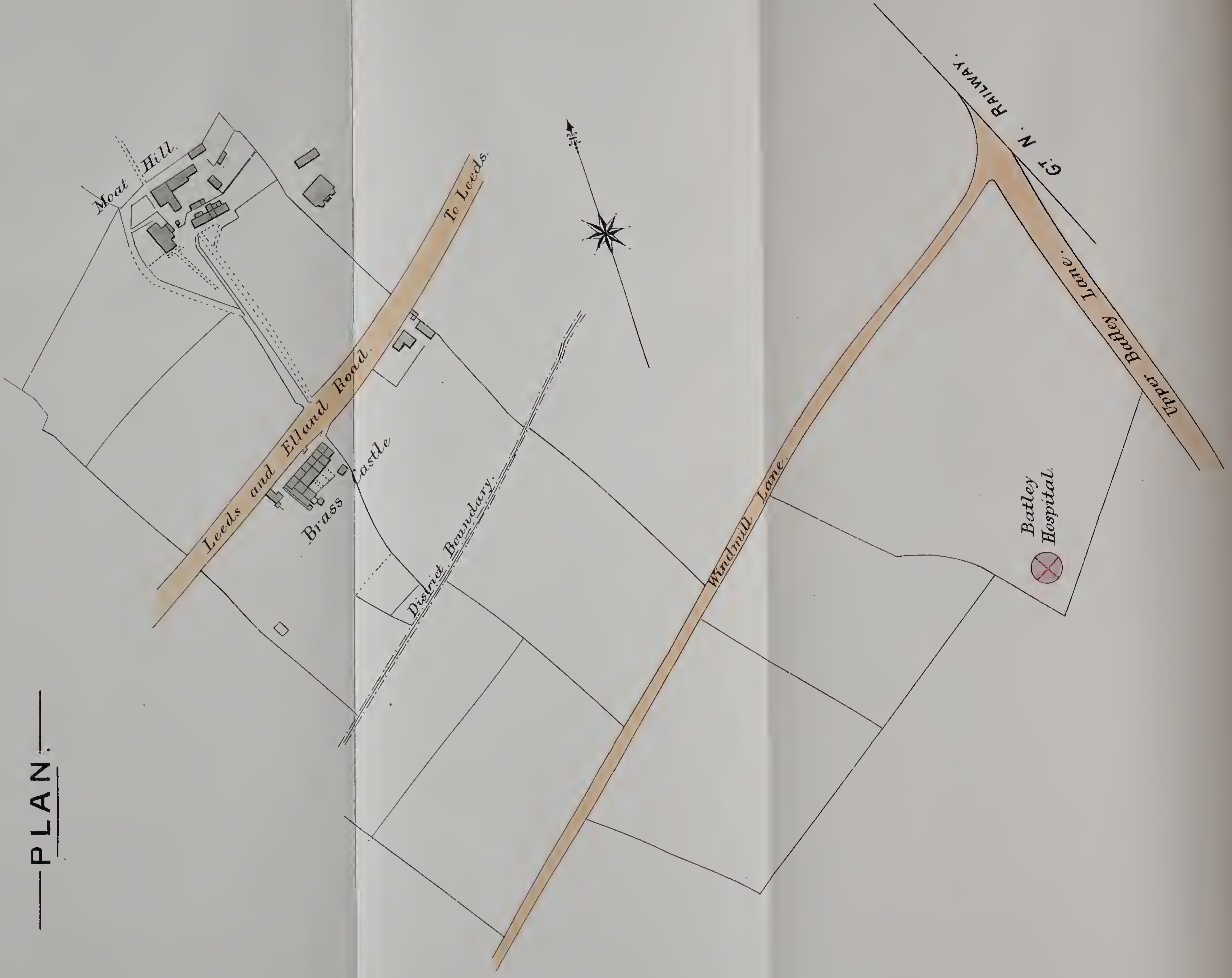
Attack Rates.

(*a.*) Of single cases.

——	Case removed.		Case remained.
	All Members.	Exclusive of those having Small-pox previously.	
	Per cent.	Per cent.	Per cent.
Vaccinated - -	15·9	16·6	23·0
Unvaccinated - -	40·2	41·6	—

(*b.*) Of multiple cases attacked subsequent to removal of the initial cases.

——	All Members.	Exclusive of those who had Small-pox previously.
	Per cent.	Per cent.
Vaccinated - - - -	21·7	22·5
Unvaccinated - - -	60·7	63·0


Moat Hill
To Leeds
Leeds and Elland Road
Brass Castle
District Boundary
Windmill Lane
Gᵀ N. RAILWAY.
Upper Batley Lane
Batley Hospital

PLAN.

Other Districts of the Dewsbury Union than Batley and Dewsbury.

Particulars of the occurrence of small-pox in Birstal, Heckmondwike, Liversedge, Mirfield, Morley Borough, Ossett Borough, Ravensthorpe, Soothill Nether, Soothill Upper, Thornhill—Invaded houses and their inmates—Sanitary conditions—Weekly incidence of small-pox in all these districts combined—Monthly prevalence—Age and sex incidence—Occupation tables—Types of the attacks and relative proportion at different ages—Measures of isolation—Single and multiple cases in houses—Number of houses invaded per month and of cases occurring therein—Particulars of size of households, &c. of 147 *houses visited—Occupations of members of these households, proportion and attack rates among the several classes in houses having single and multiple cases—Vaccination statistics of the cases attacked with small-pox—The weekly incidence of cases with regard to their vaccination relations—Age and sex of the attacked with regard to their vaccination relations—Type of small-pox and vaccination condition—Vaccination data of inmates of houses—And of single and multiple cases.*

BIRSTAL.

During the whole period covered by this inquiry only 10 cases of small-pox were known to have occurred within the limits of this sanitary district, viz., one case in June 1891, one in December, two in January 1892, one in February, three in March, and two in April. There was one death. These cases came from seven different houses, and particulars were obtained of five of these; there being eight cases of small-pox amongst the 20 inmates, two of whom were under one year of age (one attacked), two between one year and 10 years, 14 between 10 and 30 (six attacked), and four over 30 years (one attacked). The following is a list of these households:—

Small-pox at Birstal, 1891–2.

List of Infected Households with Ages of Inmates and of those Attacked.

Date of First Appearance of Small-pox.	Street, &c.	Reference to House List.	All Inmates.				Attacked with Small-pox. (Nos. refer to Case Register.)			
			Under 1 year.	1 to 10 years.	10 to 30 years.	30 and upwards.	Under 1 year.	1 to 10 years.	10 to 30 years.	30 and upwards.
1891. June 12	College Street -	—	—	—	—	—				1
Dec. 9	Union Street -	1		1	2	1			2–3	4
1892. Feb. 15	Low Lane - -	—	—	—	—	—			5	
March 7	Moat Hill - -	4	1	1	3	2			6	
„ 22	Brasscastle -	3	1	—	1		8		7	
April 1	Brasscastle -	2			2				9	
„ 5	Howden Clough Road.	5			6	1			10	
	5 houses visited -		2	2	14	4	1	—	6	1
	2 „ not visited								1	1
							1	—	7	2

I am indebted to Dr. Forsyth for the particulars of the history of cases, so far as these could be ascertained.

The first case was that of E. W., a man æt. 43 (No. 1), who was attacked on June 12th, 1891, and removed to the union workhouse infirmary at Staincliffe on June 16. The source of infection in this case is unknown.

D. V. H., æt. 16 (No. 2), was engaged as a pawnbroker's assistant in Batley, and was attacked on December 9th. Although no direct infection could be traced in his case, it seems very probable that he may have come in contact with persons from infected houses, as at this time the disease was again spreading in Batley. He lived with his married sister at Birstal, whose husband kept an inn there, and he was nursed in the house, which was closed to customers from that time forward. The family consisted of Mr. and Mrs. C., and their infant daughter, G. C., one year old. This child underwent vaccination in January, and was the only one of the four who escaped the disease; Mrs. C. was attacked on January 12th. and Mr. C. on the 15th; the former had been vaccinated in infancy, and only kept her bed for three days; the latter was unvaccinated, and was ill with a severe confluent attack for several weeks.

Small-pox at Birstal, 1891–2.

The next case was that of W. R., æt. 16, an assistant in an upholstery shop in Birstal, and living in the house; it is not known how he was infected. He was removed to the Batley Small-pox Hospital.

The cases that followed all occurred in dwellings on the outskirts of Birstal and in the vicinity of the Batley Hospital, which at that time (March 1892) was full of cases of small-pox. The accompanying sketch-map, for which I am indebted to the surveyor to the Borough of Batley, shows the relative position of these dwellings to the hospital. The latter, it will be remembered, was situated in a field off Upper Batley (or Howden Clough) Lane, a narrow lane skirting this field (Windmill Lane) on its N.W. side, about 160 yards from the hospital. In the same direction and 440 yards from the hospital runs the high road to Leeds, passing from Birstal proper to Howden Clough, just within the eastern (Birstal-Morley) boundary of the Birstal district. To the south of this road is a row of cottages called "Brasscastle," whilst on rising ground 160 yards to the N. of the road is a farm (Moat Hill Farm). A lad, C. D., æt. 10, one of the family of six persons who, together with a maid servant, lived in the farmhouse, was attacked with small-pox on March 7th. This boy, I was informed, had been "twice" vaccinated, but if so, the vaccination could hardly have been successful, for careful scrutiny failed to reveal any vaccination scars. It was suggested that he may have been infected from the hospital, as he was known to have been in the habit of playing in the fields adjacent to it, and with other children used to watch the cartage of refuse from the hospital. As soon as he developed the disease he was removed to the hospital, and all the inmates of the farm were re-vaccinated. The cattle on the farm were removed to another farm just below Brasscastle.

Mrs. D., æt. 20, occupying one of the Brasscastle cottages, was confined on March 20th. She must have been incubating small-pox at the time, for on the 22nd high fever set in, with intense headache and backache, and on the 23rd some papules appeared. She was not then in a condition to bear removal to the hospital; and her infant was at once vaccinated, but on the 29th, when nine days old (No. 8), it developed the rash of small-pox. Both mother and infant were then removed to the hospital, where the latter died on April 1st. The husband, J. D., æt. 21 (No. 10), the only other inmate of the cottage, on the development of small-pox in his wife, removed to his mother's house at Howden Clough, near to the mill where he was working. There was a family of six in this house, four of whom (females) were employed in the mill, and two attending school. J. D. did not, however, escape infection, for he sickened with small-pox on April 5th, *i.e.*, 14 days after the rash appeared in his wife's case, and was removed to the hospital on April 7th. Fortunately none of his relatives at Howden Clough were infected. Dr. Forsyth kept them at home for three days and had the house thoroughly disinfected. Mrs. D., at Brasscastle, was attended in her confinement and illness by a neighbour, Mrs. B. (No. 9), who complained of feeling ill on April 1st, and developed a rash on the 3rd.

No other cases were known to have occurred in Birstal after this date up to August 27th.

Thus of these 10 cases, one, an infant of nine days, died; three remained at home during the whole of their illness, one was removed to the union workhouse infirmary, and five to the Batley Small-pox Hospital.

The *sanitary condition* of the five houses inspected was fair; all had privy middens, in one only was this ill constructed and in a bad condition. Two of the houses were detached from other buildings, one (the farm) occupying an open elevated site; two were back-to-back two-roomed cottages (Brasscastle), and the other (Howden Clough) was one of a row of six houses, with no window at the back, and two sleeping rooms and one dwelling room.

HECKMONDWIKE.

There were 39 cases of small-pox in this sanitary district during the period covered by the inquiry.* Two occurred in 1891, in June and December respectively; seven in

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* The total number notified was 40, but one of these (No. 23) was taken to hospital on suspicion, and did not develop small-pox.

Small-pox at Heckmondwike, 1891-2.

January 1892, four in February, 13 in March, five in April, four in May, two in June, one in July, and one in August. There were four deaths. These cases came from 26 different houses which were infected in the following months :—

——	Houses.	Cases.
1891.		
June	1	1
December	1	1
1892.		
January	4	7
February	2	6
March	10	13
April	2	5
May	3	3
June	1	1
July	1	1
August	1	1
	26	39

A list of these houses is given below from which it is seen that particulars were obtained of the inmates of 23 of them, comprsing 117 individuals giving an attack rate of 117 : 39, or 33·3 per cent. Of these persons, 3 were under one year of age, 27 between one and 10 years (8 attacked), 49 between 10 and 30 (18 attacked), 34 aged 30 and upwards (9 attacked), whilst the age was not ascertained in the remaining four.

SMALL-POX at HECKMONDWIKE, 1891–92.

LIST of INFECTED HOUSEHOLDS with AGES OF INMATES and of those ATTACKED.

Date of First Appearance of Small-pox.	Street, &c.	Reference to House Register.	All Inmates.				Attacked with Small-pox. (Nos. refer to Case Register.)			
			Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.	Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.
1891. June 13	Heights Lane	—	—	—	—	—			1	
Dec. 31	Lobley Street	14			3	1			3	
1892. Jan. 3	Chapel Lane	13				3 Age ? 2				2
„ 16	Brighton St.	3		2	6	2		9	4	8
„ 16	Lobley Street	16	1	2	2				7	
„ 17	Bower Lane	—	—	—	—	—				Age ? 5–6
Feb. 7	High Street	15		1	3	3		13	12	10
„ 24	Brighton St.	4		2	1	2		14, 15		11
Mar. 9	Brighton St.	7	1	2	1	1		16	17	
„ 12	Royle's Fold	1			1	— Age ? 2			18	
„ 14	Milton Street	12		1	2				19	
„ 15	Mt. Pleasant	10			2	1			21	
„ 18	Brighton St.	5			3	1			20	
„ 22	Brighton St.	8		1	3	1		22		
„ 26	Brighton St.	6		3	1	2				24
„ 28	Mt. Pleasant	11			3				25	
„ 28	Battye Street	2			1	1			38	26
„ 29	Brighton St.	9	1	1	2	2			27	33
Apr. 12	Cook Lane	18		3	3	2		30	31, 35	29
„ 18	Oxford Street	19		2	2	2		28		
May 1	Cook Lane	17			3	2			32	
„ 2	Beauregard St.	20		3		4				34
„ 17	Cook Lane	21		1	2				36	
June 11	Heights Lane	—	—	—	—	—			37	
July 22	Tower Street	22		1	4	2			39	
Aug. 17	Tower Street	23		2	1	2			40	
	23 houses visited		3	27	49	34 Age ? 4	—	8	18	9
	3 houses not visited.								2	Age ? 2

The case in June 1891 was that of an unvaccinated girl, S.D., æt. 12, living on the Staincliffe side of Heckmondwike; she was removed to the workhouse infirmary on June 20, a week after the onset of her illness, and had a confluent attack. Almost exactly a year later (viz., June 11, 1892) another case occurred in the same part (Heights Lane), a man of 24, who was removed to the Dewsbury Hospital; he was vaccinated and had a mild attack (No. 37).

On December 31, 1891, a mill hand, H. C. female, æt. 16 (No. 3), living in Lobley Street, also near the Batley boundary, sickened and was sent to the Dewsbury Hospital on the seventh day of the appearance of rash. She was the only unvaccinated member of the family, but it is not known how she contracted the disease. Up to within a fortnight of her illness her mother had been doing some laundry work for people in the same street, none coming from infected districts. On the removal of this patient the house was fumigated, and a neighbour, J.H.K., æt. 26 (No. 7), a miner at a large colliery at Dewsbury (where other cases occurred), assisted in cleansing it. At the same time it seems unlikely that he was infected there because he sickened on January 15th, only six days after the removal of H. C. He again was the only unvaccinated member of his family. He was sent to the Dewsbury Hospital on January 20th, and after his discharge acted as lodge-keeper to the Crow Nest Convalescent Home. His infant of five months was vaccinated about one week before he was taken ill, and did not have the disease.

Prior to these latter cases one was removed from an old house in Chapel Lane, inhabited by Mr. and Mrs. M. and two lodgers. Their son, A. M., who lived at Batley, had come to stay with his parents when his wife was removed to the Batley Small-pox Hospital (No. 112 in Batley Register). He (No. 2) was already suffering from small-pox, and was seen by a medical man on January 7th, and removed to Dewsbury Hospital on the 8th. The lodgers at the same time left the house.

Seven of the invaded houses were in three adjacent and parallel streets, viz., Brighton Street, Back Brighton Street, and Battye (? Roebuck) Street, cases occurring in them from the middle of January until the end of March, and numbering 15 in all. The first family to be attacked was that of Mr. S., an insurance agent, engaged in travelling about, and who may have recently been in an infected district. His daughter, N. S., æt. 14 (unvaccinated), was the first to be attacked, viz., on January 16th (No. 4). At the time of her attack there were three other children of the family of 10 who were unvaccinated; two of these, S. S., æt. 18, and R. S., æt. 15, were successfully vaccinated on January 21st, at the same time as the father and three other children (aged 21, 16, and 10) were re-vaccinated. The youngest child, M. S., æt. 3, had been vaccinated in infancy, and was not re-vaccinated. The two remaining members of the family, Mrs. S., æt. 40 (No. 8), who had two foveate marks of infantile vaccination, and who was not re-vaccinated, and a boy T. S., æt. 9 (No. 9), who remained unvaccinated, were attacked with small-pox on January 28th. It is uncertain whether they could have been infected by the first case (No. 4), as her rash only appeared on the 19th, and the mother's notion that the infection was conveyed in her daughter's clothes sent back from the hospital on the 21st is even less probable on the accepted term of incubation. Yet this may not be impossible. Nos. 8 and 9 were not removed, but were kept in a room separate from the rest, and attended only by a daughter of Mrs. S., æt. 16 (one of the re-vaccinated).

The next family to be attacked in this street was that of the V's.; the father, G. V., æt. 33 (No. 11), being attacked on February 24th, and being nursed at home throughout his illness. His wife was re-vaccinated during his illness on two occasions, both unsuccessful. The three children (æt. 10, 8, and 6) were unvaccinated, and two of them G. C., a boy, æt. eight (No. 15), and F. C., a girl, æt. 6 (No. 14), both sickened of small-pox on March 6, the rash appearing in the one (No. 14) on the 8th, on the other (No. 15) on the 10th. They were removed to Dewsbury Hospital on the 13th, where G. C. died on the 15th; and where F. V. remained until April 11th. The other child was twice attempted to be vaccinated, but both attempts failed.

On March 9, L. C., æt. 6 (No. 16), fell ill, and next day his mother, S. C., æt. 27. The boy was a delicate child and had never been vaccinated, and they were both removed to Dewsbury Hospital on the 15th. Of the other members of the family—the father—a miner, had been vaccinated in infancy, and had had small-pox in boyhood, but was successfully re-vaccinated on March 14th; a boy, æt. four, had been vaccinated in infancy, whilst an infant, two months, was not vaccinated until the 16th, and had therefore been unvaccinated when exposed to infection.

On March 18th J. R., æt. 20 (No. 20), engaged as a baker in the town, and living in Back Brighton Street, was attacked; he was removed to Dewsbury Hospital on March 21st, and died there on the 27th. He was unvaccinated. There were three other persons (adults) in the house, two of whom (aged 23 and 20) were re-vaccinated on the 21st.

In another family, G. F., a schoolboy, æt. 8 (No. 22), the only unvaccinated member, was attacked with small-pox on March 23rd, and sent to the Dewsbury Hospital on the 26th. His brother (vaccinated), H. F., a weaver, æt. 13, having slept in the same bed, was sent with him to the hospital "as a precaution, but not developing the disease "was returned to his home in a fortnight" (Mr. Fardon's note).

J. A., æt. 36, a miner, in another family (six persons) in this street, was attacked on March 26, and removed to Dewsbury Hospital on the 31st.

F. K., m., 13 (No. 27), a weaver, was attacked on March 29th, and removed to Dewsbury Hospital on April 1st. His father, J. K., æt. 42 (No. 33), sickened on April 16, and was removed on April 21st; on him there had been an unsuccessful attempt at re-vaccination on April 1st. There was a similar failure in a lad æt. 15; but in Mrs. K., æt. 44, the re-vaccination was successful. [She was confined on April 19th.]

In connection with this group may be mentioned the case of C. C., m., æt. 5 (No. 28), living in Oxford Street (off Roebuck Street), who attended the same school in Battye Street, as children coming from the Brighton Street houses. He was attacked on April 18 and sent to Dewsbury Hospital on the 23rd. He was unvaccinated, as was his younger brother (æt. two), who was, however, successfully vaccinated on April 22 (but was therefore unvaccinated when exposed to chances of infection). Three of the remaining four inmates of this house were re-vaccinated on the 22nd, but in no case with success.

In Battye Street, adjoining Brighton Street, Mrs. K., æt. 31, was attacked on March 28th (No. 26), and removed to Dewsbury Hospital on April 2nd. Her husband, who was often away from home, in his capacity as a coal agent (travelling), and who was the only other occupant of the dwelling, contracted the disease (No. 28) three months later, being attacked on June 16, clearly having been infected from another source.

Returning to cases which occurred at an earlier period, it may be noted that in the middle of January two cases (a woman and her infant) living in Bower Lane, at quite another part of the district, were attacked. On February 7th Mrs. N. (No. 10), living in High Street (near Lobley Street, where there had been cases), was attacked; on the 26th her two children, A. N., f., æt. 12 (No. 12), and A. N., m., æt. 1, this infant being unvaccinated (an unsuccessful attempt at vaccination was made on February 12). These patients were all treated at home. The house contained four other inmates, one of whom, the father of Mrs. S., had had small-pox in childhood.

In the centre of the town, near the market-place, there is a court (Royle's Fold), dirty and ill-paved, and occupied by old, neglected single-roomed shanties. In one of these, a young man, M. C. (No. 18), was removed to the Dewsbury Hospital on the seventh day of his illness, and died there on the 19th. He and his parents lived here, but Mrs. C. declined to give any information at all, beyond the fact that her son was unvaccinated.

In contrast to this, in every respect, was the case of Mrs. D. (No. 19), who occupied, with her husband and child (æt 2), a four-roomed detached house in Milton Street. She sickened on March 14th, and was kept in one room, her husband (who was re-vaccinated on the 17th) and child leaving the house for a fortnight from March 17th.

About the same time two adjacent houses of a similar class and in the vicinity of Milton Street, viz., the district called Mount Pleasant, each had a case of small-pox. The first to be attacked was H. I., æt. 26, a domestic servant, in a house of five rooms, and two other inmates. At the back of this house is a large well-paved yard, and there is some open ground between this site and Brighton Street, where, as we have seen, so large a proportion of the cases were. H. T. (No. 21) may have been infected by frequenting this region. She was unvaccinated, sickened on March 15, and was removed to Dewsbury Hospital on the 21st. Her friend, E. B., æt. 16 (No. 25), a servant in the adjacent house, sharing the same yard, was attacked on March 28th (she had been vaccinated), and was removed to Dewsbury Hospital on April 1st. Of the two other inmates of this house, Mr. S., æt. 24, was re-vaccinated on March 31, and his wife, æt 25, who showed no evidence of having been vaccinated in infancy, as stated, was also vaccinated on that day. In neither did this vaccination "take."

Small-p at Heck mondwike, 1891-2.

A short distance further west from these streets is Cook Lane, where three adjoining houses next became infected. These houses were built back to back, containing only two rooms, and were in an insanitary, neglected state. W. S. æt. 36 (No. 29), a labourer employed by the Local Board, had slight initial symptoms on April 12, and a rash on the 15th, but he went about his work (work in connexion with laying drains) the whole time, and no steps were taken to isolate him. The small dwelling contained eight inmates, and three of these, viz., C. S., f., æt. 14 (vaccinated), E. S., f., 11 (unvaccinated), and T. S., æt. 3 (unvaccinated), C. S., and T. S. (Nos. 31 and 30) were attacked on April 29th, and removed to Dewsbury Hospital on May 3 and 4 respectively, where T. S. died on May 9. A fortnight after their removal E. S. (No. 35) sickened on May 18, and was removed on May 21. The rest of family (ages 36, 16, 7, and 5) had all been vaccinated in infancy. In the adjoining house, J. G., æt. 16 (No. 32), a miner, was attacked on May 1 and removed to Dewsbury Hospital on May 4. He was unvaccinated, as were also his brothers (aged 26 and 11), who escaped the disease. The mother (æt. 51) was said to have been vaccinated in infancy, but had no marks. Mrs. B. (No. 36), living in the house at the back of the preceding, was attacked on May 17 (she had been confined nine days before of a stillborn infant), and was taken to the Dewsbury Hospital on the 21st, *i.e.*, on the third day of her rash. Although up to the time of her removal her unvaccinated child, H. B., æt. 5, slept in the same room, the latter did not contract the disease.

Of the three remaining cases, one, J. T., æt. 30, a carpet-weaver (No. 34), lived in Upper Beauregard Street near the western (Liversedge) boundary. He sickened on May 2nd, and was removed to Dewsbury Hospital on May 6th. Two adult females (æt. 32 and 33) of this household of seven persons had never been vaccinated; they had both suffered from small-pox in childhood.

In June, as stated, one case occurred at the opposite end of the district in Heights Lane; and on July 27 there occurred the case of H. H., æt. 10, an unvaccinated schoolboy (No. 39), living in Tower Street (off High Street, near centre of the town). He was removed to Dewsbury Hospital on the 27th, and on the same day his brother (æt. 13) and his sister (æt. 5) were successfully vaccinated (therefore unvaccinated when exposed to chances of infection). On the 28th each of the remaining four inmates of the house were successfully re-vaccinated. On August 17th (*i.e.*, 20 days from removal of H. H.) C. G. H., æt. 11 (No. 40), in an adjacent house in Tower Street was attacked and removed to Dewsbury Hospital on August 22. This boy was unvaccinated; it was said that there had been three unsuccessful attempts made to vaccinate in infancy. On the day of his removal the remaining four inmates (including two children, æt. 9 and 3) were all re-vaccinated.

Thus of the 39 cases, 8 remained at home during their illness, 1 was removed to the workhouse infirmary at Staincliffe, and 30 were removed to the Dewsbury Infection Hospital.

As to the *sanitary condition* it may be remarked that the privy-midden system prevailed universally; that some of these middens were common to several houses, and (especially in Brighton Street) were only a few feet distant from the houses. Three at least were below the ground level, and many were neglected and foul. Royle's Fold and Cook Lane houses were the worst and most insanitary. Of all the houses visited, six were "through" houses, one was provided with a single window at the back looking on to a narrow dirty court, the rest were "not through" houses; 14 of these being built on the "back-to-back system. The proportion of rooms (sleeping and living to inmates) was—

—	Rooms.	Inmates.	Per Room.
6 through houses - -	25	31	1·2
14 back-to-back houses - -	30	77	2·5
3 single houses - - - -	5	14	2·8

LIVERSEDGE.

In this district, contiguous to Heckmondwike, and embracing a wide area of open upland country, there were 20 cases of small-pox (one fatal) known to have occurred

Small-pox at Liversedge, 1891–2.

within the period named, viz., 1 in December 1891, 3 in January 1892, 4 in February, 11 in June, 1 in July, coming from 10 different houses, a list of which is given below. It will be seen from this list that particulars were obtained of the inmates of the houses whence 18 cases proceeded; that of the total of 56 inmates, 2 were under 1 year of age (1 attacked), 7 between 1 and 10 years (5 attacked), 26 between 10 and 30 years (5 attacked), 16 aged 30 and upwards (7 attacked), and in 5 the age was not ascertained.

SMALL-POX AT LIVERSEDGE, 1891–92.

LIST of INFECTED HOUSEHOLDS with AGES of INMATES and of those ATTACKED.

Date of first appearance of Small-pox.	Road or Street.	Refer to House Register.	All Inmates.				Attacked with Small-pox. (Nos. refer to Cases Register.			
			Under 1 year.	1 to 10.	10 to 30.	30 and upwards.	Under 1 year.	1 to 10.	10 to 30.	30 and upwards.
1892. Dec. 23	Lumb Lane -	4		1	5	2				1
Jan. 14	Lumb Lane -	3				1 Age ? 5				2 3
„ 16	Station Lane -	5		2	3	2		4		
Feb. 2	Lumb Lane -	—	—	—	—	—			5	
„ 5	Lower Hall, High Town.	1			3	1			6	
„ 1	Quaker Lane -	2			6	2			7	
„ 29	?	—	—	—	—	—			8	
June 10	Liversedge Hall Lane.	6	1		5	2			9, 10, 11	
„ 13	Huddersfield Road.	7		1	3	2		12		19
„ 24	Robert Town -	8	1	3	1	4	20	13,14, 15		16,17, 18
	8 houses visited		2	7	26	16 Age ? 5	1	5	5	7
	2 houses not visited.								2	
							1	5	7	7

For most of the following particulars I am indebted to Dr. Shives, the Medical Officer of Health to the Local Board. The first case was that of A. J., æt. 35, a miner at a large pit near Dewsbury.* He (No. 1) was attacked with small-pox on December 28, 1891, the rash appearing on the 30th. The remaining seven members of the family were all successfully re-vaccinated by Dr. Shives on December 31st, and A. J. was isolated in an upstairs room communicating by a staircase directly with the outside, so that there was no necessity to pass through the living room. He was kept there for three weeks, being attended by Mrs. J.; and on January 12, his brother, G. J., æt. 33, living in another house in the same road, who assisted to carry A. J. to the room, was himself attacked. G. J. (No. 2) was brought to this room on the 17th and looked after by A. J., whilst all the family of the former, with the exception of the youngest child, were re-vaccinated on January 17th.

The next case in the district was that of Mrs. G., æt. 35 (No. 3), who was attacked on January 16th. She may have been infected through her husband visiting houses in Batley and elsewhere in his capacity as clerk to Co-operative Stores Company. She was kept at home, all the rest of the family being successfully re-vaccinated by Dr. Shives on January 20th. The youngest of these, however, C. G., æt. 4 (No. 4), had a very scanty eruption of spots on February 2; his case being so mild as to be almost "doubtful." The rash quite cleared off and he was never really ill.

On February 2nd, another miner in the same pit as No. 1 was attacked, F. H., æt. 21 (No. 5).

On February 5 Miss M. E. D., æt. 25, employed as teacher in a large school at Dewsbury, fell ill. At the same time the head mistress (Miss G., No. 62 in Dewsbury list) was attacked and subsequently died. I have already mentioned the cases of the pupils at the school who were also attacked with small-pox at this period (*v.* "Dewsbury," page 65). Miss D. was kept at home during her illness, the three other inmates of the house (aged 48, 27, and 22) being re-vaccinated on February 9th, all successfully. The house was attached to a shop and post office, which were accordingly closed; and one of the inmates removed to another dwelling.

R. G., æt. 27 (No. 7), employed as potman at an inn in Commercial Street, Batley, was attacked on February 1st; came home to Quaker Lane, Liversedge, and developed a rash on February 3rd. There were, including the patient, eight inmates of this house, and all, except the parents, were sent away during his illness; Mrs. G., and her five children being successfully re-vaccinated on February 6th.

Mrs. S., æt. 26 (No. 8.), attacked on February 29th, was removed to the Dewsbury Hospital on March 5th. She may have been infected through her husband, a groom, visiting infected districts.

From this date no other cases occurred for more than three months. On June 10th and 11th three members of one family were attacked (Nos. 9, 10, and 11), one, G., M., æt. 29, employed as a labourer, another, C. S., as a railway clerk, and the third, L. S., æt. 19, living at home. It is not known how the infection was brought to the house, which contained in all eight inmates. The patients were kept at home, two of the family being sent away; the father, æt. 52, was re-vaccinated on June 14th, as also were a nursemaid and the nurse in attendance on the cases; whilst an infant, five months old, was primarily vaccinated at the same time. It is noteworthy that within a day or two of this house being infected, that of some relatives was also invaded, where the first to be taken ill was an unvaccinated girl, G. M., æt. 8 (No. 12), on June 13th. Her rash developed on June 16th, and on the 29th her mother, æt. 44, (No. 19), who had suffered from small-pox when four years of age, was also attacked. She was the only one of the family (five) who was not re-vaccinated; three of them were re-vaccinated on July 5th (one being unsuccessful), and one on the 10th, unsuccessful.

Seven members of a family of nine persons living in a detached dwelling, in a high and open situation, were attacked with small-pox between June 24th and July 7th. One of these cases, that of Mrs. N., æt. 33 (No. 18), was rapidly fatal, death occurring before the rash was fully out; yet it had not "hæmorrhagic" characters. Another was the case of her infant, who was vaccinated two days before the rash appeared, and had a mild attack. All the other cases were of mild type.

It will be seen that of the whole number of cases only one was removed to hospital, and that measures were taken for the isolation of the patients in their own homes, and the re-vaccination of other inmates. These measures were always promptly carried out by Dr. Shives, and this may account for the limitation of the disease in the district.

The *sanitary state* of the houses that were inspected was good in all cases. Only two of these houses were on the "back-to-back" system; and of the rest, most occupied high and open situations. The privy-midden system obtained in all. As to proportion of rooms to inmates :—

——	Rooms.	Inmates.	Per Room.
6 "through" houses - -	31	43	1·3
2 back-to-back houses -	6	13	2·1

MIRFIELD.

No case occurred in any Mirfield household before the end of February, in the 44th week of the outbreak in the Dewsbury Union. From that time until August 27th there were in all 12 cases, coming from 11 houses, viz., one in February, one in March, five in April, and five in August. One case was fatal.

The subjoined list of the houses invaded, in order of their infection, shows that in the nine of which particulars were obtained there were 53 inmates, none under one year of age, eight between one and ten years, 29 between 10 and 30 (seven attacked), 16 at 30 and upwards (two attacked).

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* I find that 10 other miners in this pit were attacked with small-pox, viz.:—8 from Dewsbury (Nos. 35, 45, 51, 58, 97, 127, 129, 146), attacked on December 26, 1891, January 15, 28, 22, February 25, March 19, 20, and April 7, respectively; 1 from Heckmondwike (No. 7), attacked on January 15, and another from Liversedge on February 2. The above case was one of the first to fall ill.

SMALL-POX AT MIRFIELD, 1891–92.

LIST of INFECTED HOUSEHOLDS with AGES of INMATES and of those ATTACKED.

Date of First Appearance of Small-pox.	Road or Street.	Reference to House Register.	All Inmates.				Attacked with Small-pox. (Nos. refer to Case Register).			
			Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.	Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.
1892. Feb. 27	West Mill Cottages.	2			3	1				1
March 14	Lee Green -	4		1	4	2			2	
April 4	Sunny Bank Road.	3		2	2	2			3	
" 11	? ?	—	—	—	—	—				Age? 6–7
" 16	Stocks Bank -	1			3	3			4	
" 24	Knowle - -	—	—	—	—	—			5	
Aug. 2	Northorpe -	9			5	3			8	
" 2	Cross Key Lane	7		1	2				9	
" 7	Stocks Bank -	8		2	5	2			10	
" 10	Lee Green -	5			1	2				11
" 9	Shill Bank Lane	6		2	4	1			12	
	9 houses visited		—	8	29	16	—	—	7	2
	2 " not "								1	Age? 2

The first case in the district was that of J. S., æt. 35, a maltster, who could not account for his infection. He (No. 1) was attacked on February 27th, developed a rash on March 1st, and was removed to the Batley Small-pox Hospital on the 5th. The three remaining inmates (aged 28, 15, and 13) were re-vaccinated on March 4th, but in only one was it successful and that slightly.

P. L., f., æt. 18 (No. 2), living in another part of this wide and thinly peopled district, was attacked on March 11th. She was a weaver at a mill in Ravensthorpe, where some of the workers were said to have come from infected houses. I find that one of the Dewsbury cases (No. 10), who was attacked on August 14th, 1891, and died in hospital on August 31st, worked at this mill, as also did No. 125 (Dewsbury), who was attacked on March 17th, 1892; and one of the Soothill Nether cases (No. 7) attacked on April 17th. But I am unable to verify the statement that at the time of P. L.'s illness some of her co-workers were coming from infected houses. She was taken to the Batley Hospital on March 22nd. This patient was unvaccinated as also was H. L., æt. 3; the latter was away from home when his sister took ill; he was vaccinated on March 14th, at the same time as the other five members of the family, all being successful.

F. D., a schoolboy, æt. 13 (No. 3), developed a rash on April 8th, and was removed to Batley Hospital on the 9th. The house is on high ground, one of a recently built block of four back-to-back houses, surrounded by fields. It was thought possible that his father and brother, who were working at a pit where others came from infected houses, may have brought the infection home. All the other five inmates were re-vaccinated on April 6 and 7, in one case only (a child of three) without success.

E. R., f., 17 (No. 4), was attacked on April 16. She attended the same Sunday school as No. 3, and may have been infected through him, although probably not directly, as she fell ill on the ninth day of his rash. She was removed to Batley Hospital on April 20.

Of the remaining cases I have nothing material to add beyond what is given in the lists and tables. In one household of nine inmates there were persons aged 45, 18, and 7 years respectively. The patient, J.O., a miner, æt. 23 (No. 10), was removed to Batley Hospital on August 12th; and the foregoing persons were vaccinated on the 11th, that is to say, they were unvaccinated during the time of exposure to chances of infection. On the same day another inmate was re-vaccinated. In another family seven inmates remaining after removal of the case (No. 8) on August 8th were all re-vaccinated. Re-vaccinations were done also in the case of the two other households.

Small-pox at Mirfield, 1891–2.

Of the whole number of cases all but one were removed to Batley Hospital.

The *sanitary conditions* of the houses are, on the whole, good; the worst were two in Stocks Bank, single houses and rather surrounded. Of seven houses of which I have these particulars, two were "through" houses, and six "not through," three of them being back to back. The proportion of rooms to inmates was :—

——	Rooms.	Inmates.	Per Room.
2 through houses - - -	11	7	1·5
6 "single" and "back-to-back" houses and ashpits - -	13	34	2·6

The privy-middens and ashpits in all cases were in good condition.

MORLEY BOROUGH.

There was no case of small-pox in Morley in 1891, but in 1892 (up to August 27, the 70th week of the whole outbreak) there were 41 cases regarded as instances of this disease, the number being largely made up of a series of cases of anomalous type occurring amongst children in the months of May, June, and July. Some of these cases had certainly variolous characters, but in a very mild form, whilst others intimately connected with them might pardonably have been regarded as varicella. Indeed, had it not been for their associations I might have felt justified in excluding them from the list, as I have done in all cases where varicella has been beyond doubt. I do not think, however, that it would be right to do so in regard to these Morley children. The 41 cases came from 22 households, the incidence of the *cases* being: January 2, March 1, April 8, May 6, June 7, July 11, August 6, and of the *houses*,—

——	House invaded.	Yielding Cases.
January - - - -	1	2
March - - - -	1	1
April - - - -	7	13
May - - - - -	1	1
June - - - -	4	11
July - - - -	5	8
August - - - -	3	5
	22	41

The total number of inmates of these houses was 127, of whom four were under one year of age (one attacked), 43 between one and 10 years (27 attacked), 53 between 10 and 30 years (11 attacked), and 27 at 30 years and upwards (two attacked). The large proportion of children attacked is accounted for by the fact above stated. There were no deaths.

Small-pox at Morley,

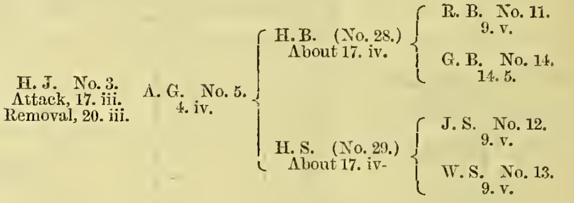
SMALL-POX AT MORLEY, 1892.

LIST OF INFECTED HOUSEHOLDS with AGES OF INMATES and of those ATTACKED.

Date of First Appearance of Small-pox.	Street or Road.	Reference to House Register.	All Inmates.				Attacked with Small-pox. (Nos. refer to Case Register).			
			Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.	Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.
1892. Jan. 18	Bruntcliffe -	7		3	1	2		1, 2		
March 17	Lobley's Yard, Queen Street.	2			2	1				3
April 2	Back Foster St. -	4			4	1			4	
„ 4	Marshall Street -	3		1	5	1			5	
„ 8	Bruntcliffe -	5			4	1			6	
„ 11	Gisborne Court, Queen Street.	1		2	3	1		8	7	
„ 14	Wordsworth Sq.	8		1	4	2			11,14, 28.	
„ 14	King Street -	11			5	1			12.13, 29.	
„ 27	Howden Clough Road.	6		1		2		9		10
May 26	Bruntcliffe -	17		3	6	2		15		
June 11	Bruntcliffe -	18		3	2	1		16, 25		
„ 18	King Street -	12	1	2	2		19	18	17	
„ 23	Garnet's Buildings.	13		3	1	1		20,21, 22.		
„ 30	Victoria Road -	9	1	3	1	3		24,26, 27.		
July 4	Bruntcliffe -	14		2	1	1		23, 37		
„ 17	St. Paul's Street -	10		2	2			30		
„ 18	Bruntcliffe -	20		1	2	2		31		
„ 23	Howden Clough Road.	21	1	4	1	2		32		
„ 24	Bruntcliffe -	15		4	1	2		33,34, 38.		
Aug. 3	Bruntcliffe -	19	1	3	3			35,39, 40.		
„ 7	Bruntcliffe -	16		2	1	1		36		
„ 27	Newsome Street, Town End.	22		3	2			41		
	22 houses -		4	43	53	27	1	27	11	2

The first cases occurred at Bruntcliffe, a part of the borough situated to the south, in the direction of Batley, the ground being high and open. In a miner's family an unvaccinated girl, H. D., five years old (No. 1), sickened on January 16, developed a rash on the 18th, and was sent to Leeds Small-pox Hospital on the 21st; on the 20th Mr. Steele, the medical officer of health (who kindly accompanied me in my visits to the infected houses) re-vaccinated the parents and a child aged 13, each successfully, and at the same time vaccinated L. D. (No. 2), a schoolgirl æt. seven, who five days later sickened with small-pox, and was sent to the Leeds Small-pox Hospital on January 29th. An infant of 20 months remained unvaccinated. It was thought possible that infection had been introduced to this house from Batley.

The case in March was that of a weaver, H. J., æt. 55 (No. 3), who sickened on the 17th. She was said to have been vaccinated in infancy, but had no marks; her son and daughter were both re-vaccinated by Mr. Steele on the 20th, the latter accompanying her mother to the temporary isolation hospital at the Cemetery Lodge, Bruntcliffe. Connected with this case is that of A. G., æt. 20, who worked next to Mrs. J. at the mill. A. G. (No. 5) sickened on the 4th, her rash appearing on the 7th. She may, however, have been infected through a visit of Mrs. J.'s daughter to the house (where dressmaking is carried on) on March 21st, *i.e.*, 14 days previously. From this case two other houses were infected, the initial cases in each being so slight as to pass unnoticed. One of them was H. B., æt. 18 (No. 28), a milliner living at Wordsworth Square. She visited A. G. before her removal to hospital on April 11th (*i.e.*, between the 4th and the 11th), and although unsuccessfully re-vaccinated on the 13th, had a pustular rash on or about the 17th April; she did not feel ill nor seek medical advice. Her sister, R. B., æt. 20 (No. 11), and a brother, G. B., æt. 12 (No. 14), sickened on May 9 and 14 respectively. There were seven members of this household, and on the occurrence of these cases three were re-vaccinated, and another attempt (which failed) was made to re-vaccinate H. B. About the same time as H. B. was attacked with what no doubt was small-pox, H. S., m., æt. 20, weaver (No. 29), living in King Street, also had a slight rash which passed unrecognised; he was engaged to H. B., and in all probability was infected through her visit to A. G. The fact of his having had a rash was not known until on May 9, two of his brothers, J. S., æt. 21 (No. 12), and W. S., æt. 19 No. 13), sickened and developed a rash on the 14th. The three remaining inmates of this house were re-vaccinated successfully on the 15th. The connexion between these cases may be thus given:—



A miner, J. A., æt. 26 (No. 4), who said that he had had small-pox when four months old, and who had never been vaccinated, was attacked on April 3rd. He may have been infected at Keighley, which he had visited about 10 or 12 days before. Mr. Steele re-vaccinated three of the remaining four inmates of the house on April 9, and vaccinated primarily M. H., f., 24, who had escaped infantile vaccination ("because she was delicate"). This young woman was, therefore, unvaccinated when exposed to infection from J. A., who was removed to hospital on April 6.

M. S., f., 29, weaver (No. 6), living at Bruntcliffe, sickened on April 8th. Two of her brothers were engaged at work in Howden Clough Mill, where, it may be remembered, there were some workers from an infected Birstal household (*see* Birstal); the man who might have been the medium of infection (Birstal list, No. 10) attending the mill during the early days of his wife's illness (March 22, 23), and afterwards from his mother's house until he himself took ill on April 5th. If the contagion was really thus conveyed it would be remarkable, and one would rather believe that the approximation of dates is only a coincidence. It is just as likely that the workers at Howden Clough conveyed the contagion from the neighbouring small-pox hospital.

The infant child, æt. 2, (No. 9), of Mr. and Mrs. H., living in the Howden Clough Road, was taken charge of by her grandmother, Mrs. S., during the day, and was probably infected by Mr. S. (No. 6), between April 8th and 14th, when Mr. S. was removed. This infant was vaccinated on April 15th, and sickened with small-pox on the 27th (she was therefore "under" vaccination when attacked.

[N.B.—Mr. Steele told me that one of these vesicles resulting from this vaccination did not "rise" until the 11th day of vaccination.]

The infant was removed to the hospital with her mother S. H., æt. 31, on April 29th, and on the 30th Mrs. H. was re-vaccinated by Mr. Steele, two large vesicles resulting. However, Mrs. H. had on May 8, two large papules appear on her face, and a day or two later other spots. It was highly probable that she had been inoculated with small-pox by her infant; she had no prodomata and did not feel ill; and had, moreover, been successfully re-vaccinated eight days previously.

E. H., æt. 24, working in Morley Main Colliery, was taken ill on April 11th; when his rash appeared on the 13th he felt so much better that he attended a football match at Bradford on the 16th, and may thus have been the means of unwittingly causing a diffusion of the disease. His case, however, was notified on the 17th, when he was removed to hospital. An infant, one year of age, whom he used to nurse, developed small-pox on April 23rd. This child had been successfully vaccinated by Mr. Steele in November 1891,, and presented four "scarred" marks. She had suffered from varicella and measles since being vaccinated; and is one of the few instances of a vaccinated child under five years of age who had small-pox in this epidemic. The four other inmates (including a boy of four, who had equivocal primary marks) were all re-vaccinated on April 18, and successfully.

There remain to be considered 13 households, and with regard to them it is noteworthy that of the 25 cases proceeding therefrom, 24 were children under the age of 10 years, viz., one under one year (unvaccinated), 12 between one and five years (three unvaccinated), 11 aged five to 10 years (one unvaccinated); four of the remainder were undergoing vaccination when attacked. Again, all the cases, with two exceptions, were of the "mild" type, and in not a few the question of varicella was raised with reason. But they were all removed to the small-pox hospital, and not one of them was infected there, as had been the case elsewhere when a child suffering from varicella had been taken into small-pox wards. The majority of the children lived at Bruntcliffe, and either attended the same school there or had brothers and sisters attending it. Thus of 15 pupils of this school in eight families, 10 had this singularly anomalous form of small-pox, and in the same houses six other cases occurred. I saw some of these cases with Mr. Steele, and was struck by their varicellous aspect (one, No. 36, in which the eruption was more profuse and discrete had some resemblance to varicella gangrenosa). In spite of these anomalies I have felt compelled to retain them in my lists, and it is needless to say that this inclusion has materially influenced the statistics of the children affected. I do not propose to give details of each of these families, but I may mention the following as a curious example :—

H. B., æt. 29, living in King Street, and his two unvaccinated children were taken ill on June 18. He (No. 17) and the elder child (No. 18), aged two years, were removed to the hospital on June 26 ; the other child, an infant of seven months, was left at home. The characters of the rash in the father's case were those of a mild form of variola, and so was that of No. 18; yet the rash on the infant, Mr. Steele informs me, more resembled varicella. This was on June 21st. However, six weeks later, viz., on August 3, the only child (vaccinated) who escaped the previous time had a papular rash with no constitutional disturbance, and three days later No. 19 was similarly affected. This eruption was considered to be varicella.

H. L., a child of two years (vaccinated), had a mild eruptive attack on July 19. This was termed "varioloid" by Mr. Steele, who says it was "certainly not varicella."

Three school children (ages six to nine) of a family living in a large semi-detached villa were attacked—the one on June 29, and the others on July 13 and 14 respectively ; in the last to suffer the rash was said to have come out in crops ; they remained in hospital until August 6th. Two of them had been unsuccessfully re-vaccinated on June 30, as also were the five other inmates of the house, four of whom were again re-vaccinated on July 15.

N. H., a boy, five years old (No. 20), attending the school referred to, was taken ill on June 20, a rash appeared on the 25th, when he was taken to the hospital. His sister æt. three (No. 21), sickened on June 27, rash June 29 ; and the infant W. H., one year (No. 22), who was vaccinated on June 25, became feverish on July 3, and had a rash on the 4th.

E. C., f., æt. 5 (No. 23), attending the same school, developed a rash on July 4; her sister, A. C., æt. 3 (No. 37), was vaccinated on July 12, and on the 21st had a similar rash.

Three cases of this class occurred in a family at Bruntcliffe, living opposite to another where two cases (H. K., æt. 4, and H. H., æt. 17 months) had occurred on June 11 hospital, June 16) and July 2 (hospital, July 2). The family consisted of a miner, G. K., æt. 25, his wife, E. K., æt. 24, her sister, L. C., æt. 17, and four children aged from five years to two months. Mrs. K. and her sister were the only ones who had been vaccinated in infancy, and the former had no marks of that vaccination. The first to be attacked was M. K., æt. 4 (No. 35), with a discrete rash on August 4, when he was removed to the hospital on the 6th. The father and other children were vaccinated on August 7th, and the two women were re-vaccinated. On the 20th, *i.e.*, 14 days after the removal of No. 35, E. K., æt. 5 (No. 30), and J. K., æt. 2 (No. 34), were attacked with a rash and removed.

To sum up, of the 41 cases, three remained at home during the attack (two unrecognised till later cases arose), two were removed to the Leeds Small-pox Hospital, and 36 were isolated in the temporary hospital at the Cemetery Lodge.

The *sanitary condition* of the houses was good ; in none did I observe any marked defects, and the privy-middens (which were the rule, in one the pail system, and two had w.c.'s. within the house) were well kept, and the ashpits well looked after. Seven were "through" houses, well ventilated; three were single houses with no through ventilation, and 12 were back to back ; the more recently constructed being in blocks of four. The proportion of inmates to rooms was as follows :—

Small-pox at Ossett, 1891-2.

——	Rooms.	Inmates.	Per Room.
7 through houses containing -	32	43	1·3
15 "single" and back-to-back houses containing.	42	84	2·0

OSSETT BOROUGH.

One case of small-pox occurred in Ossett in May 1891, in the fourth week of the general outbreak, and one in September; from that time there were no cases until February. In all 20 cases arose in the period under review, viz., one in May 1891, one in September, eight in February 1892, one in April, six in May, two in June, and one in August, the number of houses invaded being 18, there being only two houses with more than one case, one infected in February and one in May. There were no deaths.

The subjoined list gives the site of these houses and their order of infection. It will appear that they contained 89 inmates, of whom two were under one year of age, 13 between one and 10 years, 45 between 10 and 30 (14 attacked), 28 aged 30 and upwards (6 attacked), and of one the age could not be ascertained.

SMALL-POX AT OSSETT, 1891-92.

LIST OF INFECTED HOUSEHOLDS with AGES OF INMATES and of those ATTACKED.

First Appearance of Small-pox.	Road or Street.	Reference to House Register.	All Inmates.				Attacked with Small-pox. (Nos. refer to Case Register.)			
			Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.	Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.
1891. May 19	Wakefield Road -	5		1	5	2 Age ? 1			1	
Sept. 11	Flushdyke -	4		2	2				2	
1892. Feb. 6	Teall Town -	6		1	4	2			3, 4	
" 6	S. Parade Road -	9			1	1			5	
" 8	Teall Town -	7			1	1			7	
" 9	S. Parade Road -	8			4	1			6	
" 18	Pickering Lane, Gawthorpe.	3		2		2				9
" 23	Cross Rycroft St.	1		2	2	1				8
" 26	Zion Street, Gawthorpe.	2	1	2	2	2			10	
April 15	High Street, Gawthorpe.	10			4	2				11
May 4	Dale Street -	18			5	2			12	13
" 13	Healey Lane -	12			3	2			14	
" 23	Westwood Street	15			2				15	
" 24	Dale Street -	17		1		2				16
" 31	Radley Street -	13		2	3	2			17	
June 3	Rycroft Street -	16	1		3	1			18	
" 19	Westwood Street	14			1	2				19
Aug. 2	Healey Lane -	11			3	3			20	
	18 houses - -		2	13	45	28 Age ? 1	—	—	14	6

The case which occurred in May 1891 was that of the son of an innkeeper in the Wakefield Road, just within the Ossett boundary. This young man, W. D., æt. 21 (No. 1), had a butcher's stall in another part of the road. At the time of his attack there were cases of small-pox in Wakefield, and it is supposed that he was infected from there. His attack, which was a mild one, commenced on May 19 ; he was removed to the isolation hospital on the 20th, and discharged recovered on June 6th. There were eight other inmates of the house he lived in.

Small-pox at Ossett, 1891-2.

On September 11, a miner, æt. 27 (No. 2), unvaccinated, fell ill, and on the 14th developed a variolous rash. He occupied a back-to-back tenement in "Flushdyke," also off the Wakefield Road, but nearer the more populated part of Ossett. He had not been out of the district, and it could not be ascertained how he contracted the disease. He was in hospital from September 15 to October 25, his attack being complicated with pneumonia. When attacked with small-pox he had but recently recovered from influenza.

In February a group of cases occurred in Teall's Town, an outlying part of Ossett, in the south-east of the district. (*a.*) S. E. T., æt. 14, a dressmaker, and her brother E. T., æt. 12, a schoolboy (Nos. 3 and 4), were both attacked on February 4th, and removed to hospital on the 8th, on which day four other inmates of the house were re-vaccinated, only one (a boy of 11 years) successfully. It appears that—the mother, who keeps a general dealer's shop at this house, had purchased some clothing from a secondhand clothier at Leeds about three weeks previously, and No. 3 stayed at home from her work to make up a dress for herself from some of this material about a week before she and her brother were attacked. It could not, however, be proved that this clothing came from an infected house. (*b.*) T. T., æt. 19 (No. 5), a miner, living in South Parade close by, and a cousin of the preceding, was attacked on February 6. He was well vaccinated, having seven excellent foveate marks. (*c.*) Mrs. R., æt. 36 (No. 7), a friend and neighbour of the (*a*) family, sickened on February 8th, and was removed to hospital on the 11th, the day after the rash appeared. Her husband was re-vaccinated on the 12th, but it did not take. (*d.*) A. C., æt. 19 (No. 6), a plumber's assistant, living at South Parade, also a relation of the first family, and frequently at their house, was attacked on February 9, and removed to hospital on the 11th. There were four other inmates of the house he dwelt in who were re-vaccinated on February 10, one succeeded well (f., æt. 28), one doubtfully (m., æt. 16), and two failed (f., æt. 24; m., æt. 14). There can be little doubt that these cases were all infected about the same time from a common source.

The next case was that of a mason, æt. 42 (No. 9), living at Gawthorpe, which forms the north-western part of the borough adjoining Soothill Upper. He was attacked on February 18, removed to hospital on 21st, and his two children, æt. 7 and 4 years, were vaccinated successfully on the 23rd. They were, therefore, unvaccinated when exposed to the chance of infection. The man had been at work in Saville Town, adjoining Dewsbury.

W. P., an engineer, æt. 32 (No. 8), living in Cross Rycroft Street, in the north-eastern part of the town of Ossett, was attacked on February 23, and removed to hospital on 25th. He had been shortly before his illness visited by a friend from Dewsbury. His wife, æt. 29, was revaccinated on the 25th; and there were children (ages 10 to 5), one of whom had been unsuccessfully vaccinated in infancy, and the others, not previously vaccinated, were vaccinated at the same time.

No. 10 was a man, æt. 29, living in Gawthorpe, who was attacked on February 26. He was said to have been vaccinated in infancy, but had no marks. On his removal to hospital (February 29) his two youngest children (æt. three years and nine months respectively) were primarily vaccinated successfully. It is not known where he was infected.

No. 11, æt. 48, a butcher in High Street, Gawthorpe, sickened on April 15th, the rash appeared on the 18th, and he was removed on the 19th. Re-vaccination was offered to the other inmates, but declined; they were kept at home for five days after his removal.

Of the remaining cases it may suffice to say that the source of infection could not be clearly traced in any, although one or two were probably infected from a single source. Thus No. 15, H. R., æt. 23, a rag merchant, was attacked on May 23; No. 16, S. J. S., æt. 34, a rag-sorter at R's. mills, was attacked on May 24, the coincidence suggesting exposure to a common focus. There were three other persons engaged in the rag trade (each at different mills) who were attacked, viz., C. M., æt. 16, f. (No. 17), a rag-sorter, attacked May 31; J. S., æt. 25 (No. 19), rag merchant, attacked June 3rd; J. A. T., f., æt. 20 (No. 20), a rag-sorter, attacked August 3rd.

It may be observed that every case was removed to hospital with great promptitude, never later than the day following the appearance of rash. Of 26 persons who were re-vaccinated after being in contact with the case, 12 only "took," eight children, who were unvaccinated at the time that the case of small-pox was in the house, were successfully vaccinated on the removal of the case.

As regards *sanitary conditions*, at least four of the privy-middens were in a bad state, two on the old "open" plan, with ashpits also open and much below the surface, only one house had a w.c.: eight were through houses, one a "single" house, and nine "back-to-back" houses. The proportion of inmates to rooms (both sleeping and dwelling) was —

—	Rooms.	Inmates.	Per Room.
8 "through" houses - -	36	47	1·3
9 "back-to-back" and single houses.	25	42	1·6

RAVENSTHORPE.

There was one case of small-pox in 1891, and 16 in 1892 in the period here reviewed. The cases were distributed thus:—One in November 1891, one in February 1892, two in March, two in April, eight in May, one in June, two in August. They came from 14 houses, in three of which there was more than one case. There were no deaths.

The place and order of infection of these houses are given in the subjoined list, from which it appears that they contained 90 inmates, viz., three under one year of age, 20 between one and ten years (three attacked), 44 between 10 and 30 years (seven attacked), 23 aged 30 and upwards (seven attacked).

SMALL-POX AT RAVENSTHORPE, 1891–92.

LIST of INFECTED HOUSEHOLDS with AGES of INMATES and of those ATTACKED.

First Appearance of Small-pox.	Street.	Reference to House Register.	All Inmates.				Attacked with Small-pox. (Nos. refer to Case Register.)			
			Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.	Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.
1891. Nov. 3	Albion Street -	6			7	2			1	
1892. Feb. 6	Commercial Street	5	1	3	4	2				2
March 15	Queen Street -	1		2		2				4
" 16	Queen Street -	2	1	1	2			9	3	
April 3	Day Street -	4		1	6	2			5	
" 4	North Road -	3			2				6	
May 1	Union Street -	9		2	2	2				7, 11
" 7	Commercial Street	11	1	4	4	2				8
" 8	Raven Street -	12		1	1	2		10		
" 20	Sackville Street -	8		1	2	2				12
" 27	Fox's Mill -	10		3	1	2		14	13	
June 1	Queen Street -	7		2	6	2			15	
Aug. 20	Deanley Street -	14			5	2				16
" 23	Albion Street -	13			2	1			17	
	14 houses - -		3	20	44	23	—	3	7	7

The first case known to occur in Ravensthorpe was that of E. K., æt. 15, a domestic servant, who came to her home in Albion Street every night. The origin of her illness could not be ascertained, for although her master had duties at a large mill where cases of small-pox occurred three months subsequently, there were none at this date, so far as I can make out, among the workers at this mill or their families. She (No. 1) was attacked on November 3rd, the rash appeared on the 6th, and she was removed to the Dewsbury Hospital the same day. She was unvaccinated, as also was her brother, G. K., who was not vaccinated until January 1892. [Albion Street is one of a group of streets which were formerly much neglected, ending blindly; but within the past two years they have been opened out and repaved. Ravensthorpe is on low ground quite in the Calder basin; but of late years its drainage has been much improved.]

No other case occurred until February 6th, when M. P., æt. 40 (No. 2), a mason engaged at Dewsbury Moor (where he may have been infected) was attacked. Commercial Street, where he lived, is parallel to Albion Street, and cases occurred in both these streets again much later (May and August). The four-roomed house (two of which only were sleeping rooms) contained 10 inmates, the ages of the eight children ranging from 18 years to two weeks, this infant being the only unvaccinated member of the family. M. P. was removed on February 13th for isolation to the Engine House at the Sewage Pumping Station, where he was nursed by his wife and where he remained until March 14th.

R. C., æt. 30, a house painter (No. 4) who had been employed in painting the annex then in course of erection to the Dewsbury Fever Hospital, was attacked on March 15th, and removed to the hospital on the 23rd. E. C., f., 24 (No. 3), living in the same street, was attacked on the 16th and removed to the hospital on the 19th. She had two unvaccinated children, æt. four years and five weeks respectively; and on the 10th day of her return home (April 29) after a fortnight's stay at Crow Nest, one of these, A. C., æt. four (No. 9), was attacked (*i.e.*, on May 8), and was removed to hospital on the 11th. His attack was a discrete one, and he returned home on the 9th June. The infant was vaccinated when its mother was in hospital.

H. M., æt. 22, a miner at work recently at Barnsley returned to his home in Day Street, Ravensthorpe (he used to come home at the end of every week), when he was taken ill with small-pox on April 3rd. He was the only unvaccinated member of a family of nine, and was removed to the hospital on April 7th.

W. S., æt. 24 (No. 6), living with his wife in a back-to-back two-roomed house in the North Road, was attacked on April 4th. He was out of work at the time, but his wife was employed as a rag-sorter.

The next case was that of E. S., 37, a blanket-weaver, (No. 7), who sickened on May 1st and was removed to hospital on the 4th; his wife was attacked on the 17th; but their four children, including one unvaccinated (æt. eight), escaped. Similarly, in the house of T. M., æt. 36 (No. 8), who was attacked on May 7th and removed on the 10th; there was one unvaccinated child (æt. three months), and one who was alleged to have been vaccinated but had no marks (æt. three years), the remaining seven children all unvaccinated; and the father, who had had small-pox in childhood, unvaccinated. There was no second case in this house.

Per contra, A. D., æt. 10 (No. 10), a schoolboy, was the only unvaccinated member of a family of four; he was attacked on May 8, and removed to hospital on the 14th, the fourth day of his rash. His sister, H. D., æt. 17, was re-vaccinated (unsuccessfully) on the 20th June. J. L., æt. 36 (No. 12), was employed at a mill, amongst whose workers were some coming from infected houses, and where a worker (No. 5) had been attacked on April 3.* This man, J. L, was attacked on May 20, and removed on the 23rd.

Two children (H. H., æt. 10, vaccinated, No. 13; and P. H., æt. 3, unvaccinated, No. 14) of a mill overseer, and living in a house on the mill premises, were attacked on May 27 and 29. I was unable to ascertain whether at the time there were any of the mill hands infected or coming from infected houses. The parents both had small-pox in youth; and of the remaining two children who were not attacked, the youngest, aged one year, was unvaccinated.

The remaining cases were all of mill hands. One, A. D., f., 19 (No. 15), who had no marks of her alleged infantile vaccination, was attacked on June 1; she worked at a mill at which also worked one of the Dewsbury patients (No. 149), who had been attacked April 14. Another, O. W., f., 22 (No. 17), attacked August 23, worked at a mill where there also worked members of the households of No. 233 (Dewsbury), who was removed to hospital on June 21, and of No. 248 (Dewsbury) removed July 16.

Thus of the 17 cases occurring at Ravensthorpe, none were kept at home; one was isolated at the Sewage Works engine house, and the rest taken to Dewsbury Hospital.

Small-pox at Ravensthorpe, 1891-2.

As to the *sanitary conditions*, there were privy-middens in connexion with all the houses, mostly, however, in well-kept state. There were 5 "through" houses, 6 "single" houses without through ventilation, and 3 "back-to-back" houses. The proportion of inmates to rooms are—

—	Rooms.	Inmates.	Per Room.
5 through houses - -	27	41	1·5
9 "single" and "back-to-back" houses.	24	49	2·

SOOTHILL NETHER.

There were 14 cases of small-pox in the district of Soothill Nether during the year 1892, viz., January 2, February 2, March 1, April 5, May 2, June 2, each coming from a different house. There were no deaths.

In the subjoined list of these households it will be seen that in the 12 of which particulars were obtained there were 68 inmates, viz., 11 between the ages of 1 and 10 years (two attacked), 32 between 10 and 30 (six attacked), and 25 aged 30 and upwards (four attacked).

SMALL-POX AT SOOTHILL NETHER, 1892.

LIST of INFECTED HOUSEHOLDS with AGES of INMATES and of those ATTACKED.

First Appearance of Small-pox.	Street, &c.	Reference to House Register.	All Inmates.				Attacked with Small-pox. (Nos. refer to Case Register.)			
			Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.	Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.
1892. Jan. 27 -	Church Hill, Earlsheaton.	1			1	2			1	
" 27 -	Cross Street, Earlsheaton.	9				4				2
Feb. 18 -	Walker Street -	2			2	2				3
" 25 -	Town Street -	4			2	2			4	
March 15	High Road, Earlsheaton.	3		1	7	2			5	
April 2 -	Town Green -	8			3	3			6	
" 17 -	Chickenley Heath	6		1	1	2			7	
" 20 -	Chickenley Lane -	5			5	2			8	
" 23 -	Stocks Fold, Earlsheaton.	7		2		2				
" 28 -	Brook's Buildings, Chickenley.	10		2	5	2				10
May 2 -	Chickenley Heath	—	—	—	—	—				11
" 24 -	Bank Foot, Earlsheaton.	11		2	4	2		12		
June 6 -	CommonSide, Earlsheaton.	12		3	2			13		
" 14 -	Robinson's Yard, Earlsheaton.	—	—	—	—	—			14	
	12 houses - -		—	11	32	25	—	2	6	4
	2 houses - -								1	1

The first case was that of H. C., æt. 17 (No. 1), a "piecener" in a large mill at Densbury. He was attacked on January 27, and removed to Dewsbury Hospital on February 6. A man employed at the same mill had his wife and children down with small-pox (Nos. 36 to 39 in Dewsbury Register) 3 weeks before, the last to be removed to hospital being on January 4th; and a case (No. 41 in Dewsbury Register) was removed on January 11 from a house where another worker at this mill lived.* H. C. was unvaccinated.

On the same day as No. 1, J. S., æt. 32, also a mill hand, and living also in the Earlsheaton quarter of Soothill Nether was attacked, and removed to Dewsbury Hospital on February 6, seven days after appearance of rash. His sister worked at the same mill, as did a subsequent case (No. 4), and also some inmates of houses whence Nos. 5 and 10 were removed in March and May.

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* The sister of a man at Soothill Nether (S.N. 7), who was attacked on April 17th, and removed to hospital on the 21st, worked at this mill.

* Other cases amongst the families of the hands at this mill occurred at later dates, viz.:—Soothill Nether, No. 8, attacked March 15 (four workers); Soothill Upper, No. 7, attacked February 8, where there were two such workers; No. 20, attacked April 9 (one worker from this mill in house); Nos. 24 to 26, attacked from May 17 to June 9 (two workers at this mill in house).

Small-pox at Soothill Nether, 1891-2.

Mr. H. S., the sanitary inspector to the district, had assisted in the removal of Cases 1 and 2 to the hospital on February 6th, and on the 18th was himself attacked. He was nursed at home and made a good recovery; the three other members of his family being re-vaccinated successfully by Mr. Clay on February 20th.

J. E., m., 27 (No. 4), was attacked on February 25; his fellow-worker at T——'s mill returned to his work from the hospital on the 15th, and J. E. "felt afraid on seeing " him that he himself would be attacked."

L. S., f., æt. 27 (No. 5), is also a mill hand, her father and brother being employed at T——'s mill, and two brothers and sisters at the mill in Dewsbury where No. 1 worked. She was attacked on March 15th and removed to hospital on the 19th. There are 10 in the family (three sleeping rooms), all vaccinated.

E. G., m., æt. 11 (No. 6), a schoolboy, was attacked on April 2, but the cause of his infection is not clear. He was unvaccinated, and three of the remaining five members of the household had previously suffered from small-pox.

The next case was that of a miner, W. A., æt. 21 (No. 7), living at Chickenley Heath, an open district bordering on Ossett. He was attacked on April 17th and thought that he might have been infected on a visit he had paid to Heckmondwike some 10 days previously.

Another case at Chickenley occurred on April 20th. This was a girl æt. 15 (No. 8), a weaver, the only unvaccinated member of her family (seven individuals). She stated that on April 9th she had gone to Howden Clough with some friends and had been "much alarmed at seeing some of " the convalescent patients of the small-pox hospital who " were in the field adjoining the lane down which she " passed." There is, however, no evidence that she came in contact with any infected person or visited any infected house.

A third case at Chickenley is that of G. S. D., æt. 40 (No. 10), employed in a wool mill at Ossett. I cannot find that there were any persons from infected houses working at this mill at the time, but in June and August there were some. G. S. D. sickened on April 28, and was removed to Dewsbury Hospital on May 4th. He and all the members of his family were vaccinated.

E. P., f., æt. 7 (No. 12), living at Earlsheaton, was attacked on May 24th. She attended a school at Eastboro', Dewsbury, where there had been a case the previous month (D. 154, attacked April 15), and where subsequently four children in another family (D. 235, 244, 250, 254) and of the same school were attacked (July 2nd to 27th) two of them after having had varicella, and another (D. 228) child from a third family attacked with very mild small-pox on June 3rd.

E. A., m., æt. 5 (No. 13), probably was infected in the hospital, whither he had been removed on June 19th. He had been taken ill on the 6th, when a rash appeared, and on the 13th and 19th his sister (æt. 7) and brother (æt. 2) were attacked with varicella. When in hospital on June 20th (*i.e.*, the 12th day of his residence) he was again taken ill, and a variolous rash appeared on the 23rd. This child attended the same school as his sister, and as G. H. (No. 14), an unvaccinated child, whose attack was comparatively mild, and who whilst in hospital (where she was taken on the 27th June) had an attack, supposed to be scarlet fever.

Thus of these 14 cases, one was treated at home, the rest removed to Dewsbury Hospital.

As to *sanitary condition*, all the houses had privies in connexion with them, and the state of these was good. Only two were through houses having together 9 rooms and 16 inmates, or 1·8 per room. There were nine "back-to-back houses," and one "single" house without through ventilation; these had in all 24 rooms and 52 inmates, or 2·1 per room.

SOOTHILL UPPER.

There were 26 cases of small-pox occurring in the district of Soothill Upper within the period covered by this inquiry. One of these was in June 1891, the rest occurred from January to June 1892, viz.:—January 4, February 4, March 3, April 4, May 3, June 1. Four cases were fatal. They proceeded from 19 different houses, and it may be convenient to group them according to the four several parts of the district in which they occurred. For Soothill Upper contains a large tract of agricultural upland, and its inhabited parts are gathered around four centres. To the north of the district, adjoining Batley, is Soothill Lane; to the east in much open country is Chidswell; to the west on a high cliff overlooking Batley Carr is Hanging Heaton, whilst south and passing into Dewsbury and Soothill Nether is the Leeds Road. The number of houses and of the cases proceeding from them in each month in these four areas were as follows :—

—	Soothill Lane.		Chidswell.		Hanging Heaton.		Leeds Road.		Total.	
	Houses.	Cases.	Houses.	Cases.	Houses.	Cases.	Houses.	Cases.	Houses.	Cases.
June 1891 - - -	—	—	—	—	1	1	—	—	1	1
January 1892 - -	1	1	—	—	2	3	—	—	3	4
February 1892 - -	1	1	—	—	—	—	2	3	3	4
March 1892 - -	2	5	1	1	3	3	1	1	7	10
April 1892 - - -	—	—	1	1	1	1	1	1	3	3
May 1892 - - -	—	—	—	—	—	—	2	4	2	4
	4	7	2	2	7	8	6	9	19	26

Particulars of the size of these households are give in the subjoined list, from which it appears that the 19 houses contained 109 inmates, of whom two were under one year of age (1 attacked), 28 between 1 and 10 years (6 attacked) 49 between 10 and 30 (14 attacked) and 30 were aged 30 years and upwards (5 attacked).

SMALL-POX at SOOTHILL UPPER, 1891–92.

LIST of INFECTED HOUSEHOLDS with AGES of INMATES and of those ATTACKED.

First Appearance of Small-pox.	Street, &c.	Reference to House Register.	All Inmates.				Attacked with Small-pox. (Nos. refer to Case Register.)			
			Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.	Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.
1891. June 13	G— Farm, Hanging Heaton.	16			3	2			1	
1892. Jan. 7	High St., Hanging Heaton.	14		2		2				2
„ 16	Soothill Lane -	3		3	6	2			3	
„ 16	High St., Hanging Heaton.	15			3	1			4, 5	
Feb. 4	Soothill Lane -	4		1	2	2			6	
„ 8	Elizabeth Place, Leeds Road.	10		1	2	1		**7**		
„ 11	Hollinroyd Road, Leeds Road.	9	1	1	1	1	**23**		8	
Mar. 2	Clay's Buildings, Leeds Road.	1		3	1	1				9
„ 11	Soothill Lane -	12			4	2			15, 16	**10**
„ 12	Chidswell -	13		2	2				11	
„ 18	Town End, Hanging Heaton.	8		4	2	1		**13**		
„ 20	High St., Hanging Heaton.	7		1	3	2			14	
„ 24	High St., Hanging Heaton.	6	1	3	3	2			17	
„ 27	Lady Anne Road -	11		1	4	2			21	18
April 5	Chidswell - -	5		2		2		19		
„ 9	Whitely's Buildings, Leeds Rd.	2			5	1			20	
„ 21	Nab End, Hanging Heaton.	17			2	2			22	
May 9	Lambfield Terrace, Leeds Road.	18		3	3	2		24, 26		25
„ 16	Battye St., Leeds Road.	19		1	3	2		27		
	19 houses - -		2	28	49	30	1	6	14	5

Soothill Lane Group.

H. I., æt. 15 (No. 3), employed as a barber's assistant at Batley, was attacked with small-pox on January 16. In the course of his work he had to attend the workhouse at Staincliffe for the purpose of shaving the inmates; and it may be remembered that at the close of 1891 there were several cases of small-pox in the isolation wards. He did not, however, see any of these patients, and it is just as likely that he was infected through persons coming to his shop from infected houses. It is curious that only a few days previously, viz., on January 11, another young man engaged as barber's assistant (in another Batley establishment) was attacked with small-pox (Batley Reg. 160); and a third one, described as a hairdresser (Batley Reg. 162), on January 10. Perhaps this occupation involving fairly close proximity to the customer may favour the transmission of contagia from the latter to the operator. H. I. belonged to a family of 11 individuals; 7 of the children, including himself, at ages ranging from 1 year to 18, being unvaccinated. Before his removal to the Dewsbury Hospital on January 19 he was isolated in the upstairs room and attended by his parents, three of the children (ages 2 to 10) being sent away from home for three weeks. There was no other case in this house.

M. H., f., æt. 25 (No. 6), was attacked on February 2nd. She was employed as weaver at one of the largest mills in Batley, whose workers had furnished several cases, including the first case that was attacked in May 1891.* She was not removed, but was nursed by her mother in a room upstairs, the rest of the family (ages 50, 19, and 4 years) remaining below.

There were three cases in the next house to be infected in this group. The first to be attacked was Mrs. E., æt. 55 (No. 10), unvaccinated. She sickened on March 11, and was removed to Dewsbury Hospital on the 18th (5th day of rash), where she died on the 23rd. Her two daughters, J. E., aged 16, and S. E., aged 13 (Nos. 15 and 16), the former being unvaccinated, were both attacked on the 24th and removed on the 28th.

On March 27, Mrs. H., æt. 45 (No. 18), living in Lady Anne Road (near the Batley Station), was attacked; she was removed to Dewsbury Hospital on April 2nd. Her eldest daughter, A. E. H., æt. 20 (No. 21), a weaver in Dewsbury, sickened on April 10 and was removed on the 17th. It is not known how the infection was introduced here.

Chidswell Group.

There were two infected houses in the whole hamlet of Chidswell. The first, Elliott's Buildings, was occupied by J. P., a miner, with his wife and two unvaccinated children. J. P., aged 24 (No. 11), was attacked on March 3rd and removed to Dewsbury Hospital on the 18th. He worked at Soothill Wood Colliery, which throughout the epidemic had furnished a considerable number of cases.†

Those in February preceding this case were Nos. 316 (Batley) attacked February 13, 346 attacked February 18, 350 attacked February 20, and 379 attacked February 25. It is clear that there must have been a common focus of infection for so many to have been affected.

The other case in Chidswell was that of a schoolgirl, æt. nine, vaccinated, two foveate marks (No. 19), living in Greave's Buildings, who sickened on April 4th. She was kept at home during her illness, the other inmates of the house being her father J. F., a miner at Soothill Wood (and possibly the medium of her infection), her mother, æt. 40, who was unvaccinated, but had suffered from small-pox in infancy, and her sister, four years of age, who had two large vaccination marks.

Hanging Heaton Group.

The first case in the district occurred in Hanging Heaton, at a farmhouse. The patient, A. F., æt. 16, was a weaver (No. 1) at a mill in Batley; four or five months later some other workers at this mill were attacked, but at this time (June 11th, 1891) she was apparently the only one of these mill-hands to suffer. It was in the seventh week of the outbreak in Batley, where ten cases only had occurred prior to this date. Like the others arising at this time, she was isolated in the union infirmary at Staincliffe on June 15th.

On January 7th, Mrs. B., æt. 33 (No. 2), was attacked. She had visited her sister Mrs. H. (No. 39 in Dewsbury Reg.) in Dewsbury a fortnight before; Mrs. H. was attacked with small-pox on December 22nd, a rash appearing on the 24th, and she was removed to hospital on the 29th. It is more probable that Mrs. B. was thus directly infected than by the conveyance of infection through her husband, a miner at Soothill Wood. She was kept at home during her illness; her husband and two children (aged eight and five years) being all vaccinated.

Small-pox at Soothill Upper, 1891–2.

M. S., æt. 19, a miner (at another pit than that above referred to), living in High Street, Hanging Heaton, was attacked on January 16th (No. 4) and his sister, H. G. S. (No. 5) on January 31st. Both were kept at home, and both although alleged to have been vaccinated in infancy bore no marks of this. They were nursed by their mother, whilst the only other member of the household, a miner, æt. 17, went away for three months on January 19th, the day on which his brother's rash appeared.

M. S., f., the unvaccinated infant child (æt. 16 months) of a miner living at Town End, was attacked (No. 13) with small-pox on March 18th. Her mother had visited J. P. (No. 11) before his removal to hospital on the 18th (he had been taken ill on the 12th), but if she had then conveyed infection to No. 13, it would make the incubation period of the latter's illness no longer than a week. It is therefore more likely that the contagion was introduced to the house in other ways, perhaps through the medium of the father, who had a fellow miner (No. 9) taken ill on March 2nd, and removed to hospital on the 7th. The child was removed to Dewsbury Hospital on the 27th, and died there on April 7th. At the time of its attack there were two other unvaccinated inmates of the two-roomed dwelling (four being vaccinated), viz., the father, who had suffered from small-pox when 10 years old, and a girl of seven years, who was vaccinated in April.

E. S., æt. 11, a schoolgirl, living next door to the house in High Street, inhabited by Nos. 4 and 5, who were kept at home during their illness. About ten days before E. S. (No 14) sickened, that house was disinfected, the fumes penetrating the other dwelling. The families used a privy common to both houses. E. S. sickened on March 20th, the rash appearing on the 23rd. She was kept at home with her mother, the father and three other children being sent away during her illness.

H. P., f., æt. 21 (No. 17), weaver at the mill in Batley where No. 6 worked, was attacked on March 24th. She and her sister worked in the same hall at the mill as M. H., of Batley (No. 460 in Batley Reg.), who was attacked on the same day. There had been no other cases previously amongst the workers in this hall; but it is highly probable that some came from infected houses. H. P. was kept at home during her illness with her mother, who was confined about a week later, the same nurse attending to both; the mother was re-vaccinated on March 25th, and the infant was vaccinated shortly after its birth. The rest of the family (father and five children) were sent away from home.

S. D. D., æt. 24 (No. 22.), the wife of a miner working at Soothill Wood, was attacked on April 21st. She was unvaccinated, and lived with her mother and grandfather at Nab End, Hanging Heaton, the former (æt. 64) bore no evidence of vaccination, and no information could be obtained as to the vaccination of the latter (æt. 89).

Leeds Road Group.

A child, J. R., æt. 7 (No. 7), attending the Eastboro School and living in Elizabeth Place, was attacked on February 8th. He was unvaccinated, and it is probable that he was infected at the school, for on the 16th a schoolfellow living at Thornhill (T. 3) was attacked, and another schoolfellow came from a house in Dewsbury where a case of small-pox occurred on the 10th (No. 69 in Dewsbury Register). I cannot find, however (in the houses of which I have particulars), any record of children at this school coming from infected houses prior to these dates. J. R. was removed to Dewsbury Hospital on February 13th, and died there on the 20th.

Mrs. S., æt. 26 (No. 8), living in Hollinroyd Road, sickened on February 11th; she was confined of a male child on the 14th, and next day she developed a variolous rash. Her infant died on the 26th, the certificate stating the cause of death as "Small-pox, 4 days."

T. E. C., æt. 31 (No. 9), a miner, working in the same pit as the father of the child M. S. (No. 13) already referred to. He was attacked on the 2nd, and removed to hospital on the 7th. His three children (aged 7, 4, and 2) were unvaccinated, two of them attended the school at Eastboro' above mentioned, and may possibly have been the medium of infection.

T. A., æt. 14 (No. 20), attacked on April 9th, and isolated in an upstairs room during his illness, which was a very mild one. He was a delicate youth, subject to hæmoptysis, but once a week delivered greengrocery in Batley and elsewhere, and may have been thus infected.

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* In my Batley Register of small-pox cases I find there are 15 persons who were engaged at this mill in one capacity or another, and, of course, there are several other workers there who were members of households in which small-pox occurred. Of these 15 cases, 1 was attacked in April 1891, 1 in May, 2 in December, 6 in January, 3 in February, 1 in March, and 1 in April. So that most occurred just about the time that the above M. H. was infected; indeed, two of the Batley patients (Nos. 279 and 286) sickened on February 3. and were therefore probably infected at the same time as M. H. Another case in Soothill Upper (No. 17), occurring in March, was that of a weaver in this mill.

† There were 28 miners engaged in this pit living in Batley who were attacked with small-pox, viz.:—1 in December 1891, 14 in January 1892, 5 in February, 3 in March, 2 in April, 3 in May.

Small-pox at Soothill Upper, 1891-2.

On May 17th J. E. B., a boy of seven years (No. 24), one of a family of six children, living in a house on high open ground, was attacked. He and his brother both unvaccinated, æt. 5, attended the Eastboro' School, where cases of varicella and one or two of variola had recently broken out (*see* "Soothill Nether, Case 12), and at the same time a girl, A. D. (æt. 7), schoolfellow, was attacked also (*v.* below). J. E. B. was removed to the hospital on May 23rd, and on May 30th his mother, æt. 42 (No. 25), was attacked, and removed June 4th. On June 9th the youngest child, æt. one, unvaccinated (No. 26), fell ill, and was removed on the 13th. On June 11th three elder children (ages 16, 14, and 13) were re-vaccinated (unsuccessfully), and on the same day the younger brother, æt. 5, was successfully vaccinated.

A. D., f., æt. 7, an unvaccinated child (No. 27), living in Battye Street, sickened on May 16th, developed a rash on the 17th, and was nursed at home. Her case was a mild one, and I am not certain that it should not be regarded as one of varicella, which was also prevalent in the Eastboro' School that she attended. The five other members of this family were re-vaccinated (successfully) on June 19th.

Thus of these 26 cases in Soothill Upper, 11 were kept at home, one was removed to the Union Infirmary, and 14 were removed to the Dewsbury Hospital.

As to the *sanitary condition* of the houses visited, there were privy-middens connected with all, five of these being in a more or less neglected state; two having open ashpits in connexion with them. There were six completely "through" houses, three in which through ventilation only effected by a back window, and 10 without through ventilation at all, five of these being "single" houses, (one of a row), and five "back-to-back." Many were in open situations and nearly all on high ground. The proportion of inmates to rooms for each class of house was:—

—	Inmates.	Rooms.	Per Room.
6 "through" houses - -	32	44	1·3
3 "partly through" houses -	8	12	1·5
10 "single" and "back-to-back" houses.	31	53	1·7

THORNHILL.

There were 20 cases of small-pox in the wide area of Thornhill during the period covered by this inquiry; and two of these ocurred in December 1891, six in February 1892, six in March, one in April, two in May, one in July, two in August. Three cases were fatal.

These cases came from 18 different houses, particulars of 17 of which were obtained.

The district extends from the high ground of Thornhill Edge, which is sparsely inhabited, to the Calder at Dewsbury. It will be convenient to group the infected houses in each of the four chief centres of population into which the district may be divided. Passing from south to north, these are:—(*a*) Thornhill Edge, about 350 to 500 feet above sea level; (*b*) Thornhill, 300 to 400 feet above sea level; (*c*) Thornhill Lees, 150 feet above sea level; (*d*) Saville Town, about 100 feet above sea level. The months in which the houses in these centres were infected, and the cases proceeding therefrom, are as follow:—

—	Thornhill Edge.		Thornhill.		Thornhill Lees.		Saville Town.		Total.	
	Houses.	Cases.	Houses.	Cases.	Houses.	Cases.	Houses.	Cases.	Houses.	Cases.
December 1891 - -	—	—	—	—	—	—	1	2	1	2
February 1892 - -	—	—	1	1	2	3	2	2	5	6
March " - -	1	1	2	2	3	3	—	—	6	6
April " - -	—	—	1	1	—	—	—	—	1	1
May " - -	—	—	—	—	—	—	2	2	2	2
July " - -	—	—	—	—	—	—	1*	1	1	1
August " - -	—	—	—	—	1	1	1	1	2	2
	1	1	4	4	6	7	7	8	18	20

* Not visited.

The total number of inmates of the 17 houses of which I have particulars was 97, of whom 3 were under 1 year of age, 16 between 1 and 10 years (2 attacked), 50 between 10 and 30 (12 attacked), and 28 aged 30 and upwards (5 attacked).

SMALL-POX AT THORNHILL, 1891–92.

LIST of INFECTED HOUSEHOLDS with AGES of INMATES and of those ATTACKED.

First Appearance of Small-pox.	Street, &c.	Reference to House Register.	All Inmates.				Attacked with Small-pox. (Nos. refer to Case Register.)			
			Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.	Under 1 year.	1 to 10 years.	10 to 30 years.	30 years upwards.
1891. Dec. 7 -	Saville Green, Saville Town.	12			3	1			1, 2	
1892. Feb. 6 -	Mountain View, Thornhill Lees.	6		1		2		3		8
" 21 -	Coombs Road -	4			2	1			**4**	
" 22 -	Scarboro' Terrace, Saville Town.	10				2				5
" 26 -	Forge View, Thornhill Lees.	7	1		4	1			6	
" 28 -	South Street, Saville Town.	11		3	4	4				7
March 1	Thornhill Edge -	13			6	2			10	
" 2 -	Thomas Street, Thornhill Lees.	5		1	2				9	
" 5 -	Thornton Road, Thornhill Lees.	8		1	4	2			12	
" 10 -	Nursery Street, Thornhill Lees.	9			5	1			11	
" 26 -	Coombs Road -	1		4	2			**13**		
" 26 -	Hall Lane - -	3			4	1			14	
April 1 -	Wells Street -	2			1	3				15
May 5 -	Kaye Street, Saville Town.	14			4	3			**16**	
" 7 -	Leamington Terrace, Saville Town.	15			5	2				17
July 20 -	—— Saville Town.	—	—	—	—	—		18		
Aug. 14 -	South View, Saville Town.	16	1	2	1	1			19	
" 14 -	Thornton Road, Thornhill Lees.	17	1	4	3	2			20	
	17 houses visited -		3	16	50	28	—	2	12	5
	1 house not visited							1		

The case at Thornhill Edge was that of a miner, æt. 25, who sickened on March 1, developed a rash on the 8th, and was removed to Dewsbury Hospital on the same day. No other case occurred in the family of seven persons, one of whom (æt. 19) was unvaccinated.

Thornhill Group.

H. B., f., 22 (No. 4), a rag-picker in a Dewsbury mill, was attacked on February 21st. She had a confluent attack and died on March 7, having been treated at home. She was vaccinated, and Mr. Davies, medical officer of health, says that she had "two imperfect marks"; her sister says that she had "a very bad arm after vaccination."

This young woman was said to have contracted the disease from a fellow worker at the mill, who was removed to the hospital exactly a fortnight previously, but I have been unable to trace this case.

L. A. B., a schoolgirl, æt. 6 (No. 13) unvaccinated, sickened on March 26th, and removed to hospital on the 30th. The origin of her infection is doubtful. Two other children (aged two and one year), were also unvaccinated; the mother stating that all three were declared unfit to be vaccinated in infancy.

H. B., 24, a house painter (No. 14), was attacked on March 24. He had been engaged on the 9th and 10th in repapering, &c., the house occupied by No. 4. His mother and one sister (æt. 29) were unvaccinated. Another sister (æt. 21) was engaged during the week as a machinist in Huddersfield, coming home every week end. She went to Huddersfield on April 3, and on the 11th was removed to the infectious hospital there, suffering from small-pox.

L. C., 37 (No. 15), also a house painter, who sickened on April 1st, *may* have contracted small-pox by being engaged in limewashing an infected house at Thornhill Lees on

March 8th to 11th, but if so, the incubation period would have been prolonged beyond the usual term of 14 days. He was removed to Dewsbury Hospital on April 4th.

Thornhill Lees Group.

A. C., æt. 9 (No. 3), unvaccinated, was attacked on February 15, and was removed to the Dewsbury Hospital on March 4th. He was attending the school at Eastboro', one of his schoolfellows also being attacked about the same time (viz., S. U. 7, on February 8). His foster mother, A. P., æt. 40, was attacked on February 26, and removed to hospital together with him. Her husband (the only other inmate of the house) had had small-pox in childhood.

E. S., f., 24 (No. 6), a rag-picker at a mill in Dewsbury, where at the time no other cases occurred or others coming from infected houses, was attacked on February 20, and removed to Dewsbury Hospital on March 2nd. There was an unvaccinated child, æt. 7 months, in the family.

Another case, the origin of which could not be traced, is that of A. L., 24 (No. 9), employed in the bottle works at Thornhill. I cannot find that at this time (except from the house of No. 6) there was any other worker from an infected house at these works. A. L., who was unvaccinated, sickened on March 4, and was removed on the 6th.

L. J., f., æt. 21 (No. 12), was a rag-picker and fellow worker with the girl, H. B. (No. 4), who died on March 7. H. B. was last at work on February 20th, and L. J. did not sicken until March 15. She was unvaccinated. Her mother, æt. 39, was also unvaccinated, and so were her two sisters (aged 12 and 3 respectively). These latter were vaccinated on March 25, *i.e.*, seven days after L. J. had gone to hospital. Mrs. J. had previously suffered from small-pox.

H. E., f., 12 (No. 11), two of whose brothers were engaged in the same works as No. 9, was attacked on March 10, and removed to Dewsbury Hospital on the 12th.

No other case occurred at Thornhill Lees until August, when C. L., f. 13, one of a family of 10, and herself occupied in house work, was attacked on August 14th (No. 20), the source of her infection being unknown. She was removed on August 19; the only unvaccinated members of the family being a girl of three years and an infant of six months.

Saville Town Group.

This is a comparatively recently built over district, only separated from Dewsbury by the Calder. On December 7, 1892, T. C., æt. 15 (No. 1), who served at his father's fish stall in Dewsbury market-place, was attacked with small-pox. He was unvaccinated and was sent to Dewsbury Hospital on the 19th. On December 21st, his sister, M. A. C., (No. 2) æt. 20, vaccinated, who kept house, was also attacked; she was removed on January 1st. Another sister, a weaver, æt. 17, who had not been vaccinated in infancy was vaccinated on December 10th. It is noteworthy that the vaccinated sister who remained at home with her sick brother was infected, whilst the unvaccinated (at that time) sister, who went out to work daily, and did not come in contact with the patient, escaped.

W. A., æt. 42 (No. 5), engaged in a large confectionery establishment in the Bradford Road, fell ill on February 22, and had a very mild attack. He remained at home, the only other inmate of the house being his wife, who was re-vaccinated on March 3. He thinks he may have been infected by intervening applicants for work who came from Batley. None of the actual workers in the establishment had the disease.

S. K., æt. 30 (No. 7), sickened on February 28th. He had been employed for from four to six weeks in work at the new buildings at the Dewsbury Small-pox Hospital, where he doubtless received his infection. He was removed to the hospital on the 3rd; but on the 29th (*i.e.*, day after onset of illness, and two days before the rash appeared) a large party of friends assembled in the house, most of whom went up to his room to see him. No cases appear to have arisen from this exposure to an infected person in the prodromal stage of the disease.

The next case in this part of the district occurred on May 5. It is that of J. H. W., æt. 26 (No. 16), who followed the occupation of a carrier, and may have visited infected houses. He was unvaccinated and died in Dewsbury Hospital to which he had been taken on May 8. One other member of the household (a man æt. 31) was also unvaccinated.

T. B., æt. 52 (No. 17), was attacked on May 7th, and removed to Dewsbury Hospital on the 11th. The cause of his infection is not known; he lived at home, but one of his daughters was a rag-sorter at a mill which had furnished cases.

Small-pox at Thornhill, 1891-2.

The last case is that of Mrs. B., æt. 22 (No. 19), who was unvaccinated; she sickened on August 14th, and was removed on the 19th. Her three children (aged three years, two years, and 10 months) were also unvaccinated.

Thus of the 20 cases occurring at Thornhill, two only were treated at home, 18 were removed to Dewsbury Hospital.

As to the *sanitary condition* of the houses inspected, all seemed to be in a satisfactory state; in about one half the privies were of modern construction ("model" type). There were nine "through" houses, and eight in which there was no through ventilation, one of these being a "single" house, the rest "back-to-back." The proportion of inmates to rooms in each class was:—

——	Rooms.	Inmates.	Per Room.
9 "through" houses - - -	37	57	1.4
8 "back-to-back" and "single" houses	24	46	1.9

It will be convenient to consider the statistics of these cases proceeding from districts of the union other than Batley and Dewsbury in a collected form, and therefore in the various charts and tables I have used the phrase "other districts" to denote these places, which have just been discussed in turn.

Weekly incidence in other districts than Batley and Dewsbury.

The total number of cases of small-pox known to have occurred in the other districts of the Dewsbury Union besides Batley and Dewsbury amounted to 219, and for the sake of convenience these will now be dealt with under the one heading.

The attacks occurred in the following weeks dating from the first week in which cases appeared in the Union. (See Chart V.)

TABLE LXIV.

OTHER DISTRICTS.—WEEKLY INCIDENCE of CASES of SMALL-POX (Chart V.).

Week of Outbreak.	Ending.	Cases.	Deaths.
	1891.		
iv.	May 23 - - -	1	—
v.	„ 30 - - -	—	—
vi.	June 6 - - -	—	—
vii.	„ 13 - - -	3	—
viii.	„ 20 - - -	—	—
ix.	„ 27 - - -	—	—
x.	July 4 - - -	—	—
xi.	„ 11 - - -	—	—
xii.	„ 18 - - -	—	—
xiii.	„ 25 - - -	—	—
xiv.	August 1 - - -	—	—
xv.	„ 8 - - -	—	—
xvi.	„ 15 - -	—	—
xvii.	„ 22 - -	—	—
xviii.	„ 29 - -	—	—
xix.	September 5 - -	—	—
xx.	„ 12 - -		—
xxi.	„ 19 - -	—	—
xxii.	„ 26 - -	—	—
xxiii.	October 3 - -	—	—
xxiv.	„ 10 - -	—	—
xxv.	„ 17 - -	—	—
xxvi.	„ 24 - -	—	—
xxvii.	„ 31 - -	—	—
xxviii.	November 7 - -	1	—
xxix.	„ 14 - -	—	—

Small-pox in districts other than Batley and Dewsbury, 1891–2.

OTHER DISTRICTS.—WEEKLY INCIDENCE of CASES of SMALL-POX—*cont.*

Week of Outbreak.	Ending.	Cases.	Deaths.
xxx.	November 21 - -	—	—
xxxi.	„ 28 - -	—	—
xxxii.	December 5 - -	—	—
xxxiii.	„ 12 - -	2	—
xxxiv.	„ 19 - -	—	—
xxxv.	„ 26 - -	—	—
	1892.		
xxxvi.	January 2 - -	3	—
xxxvii.	„ 9 - -	2	—
xxxviii.	„ 16 - -	9	—
xxxix.	„ 23 - -	2	—
xl.	„ 30 - -	6	—
xli.	February 6 - -	9	—
xlii.	„ 13 - -	5	1
xliii.	„ 20 - -	4	—
xliv.	„ 27 - -	12	2
xlv.	March 5 - - -	6	—
xlvi.	„ 12 - - -	9	3
xlvii.	„ 19 - - -	9	3
xlviii.	„ 26 - - -	9	1
xlix.	April 2 - - -	9	1
l.	„ 9 - - -	8	—
li.	„ 16 - - -	7	—
lii.	„ 23 - - -	9	—
liii.	„ 30 - - -	5	1
liv.	May 7 - - -	9	1
lv.	„ 14 - - -	8	—
lvi.	„ 21 - - -	6	—
lvii.	„ 28 - - -	5	—
lviii.	June 4 - - -	5	—
lix.	„ 11 - - -	6	—
lx.	„ 18 - - -	6	—
lxi.	„ 25 - - -	8	—
lxii.	July 2 - - -	6	1
lxiii.	„ 9 - - -	2	—
lxiv.	„ 16 - - -	2	—
lxv.	„ 23 - - -	6	—
lxvi.	„ 30 - - -	2	—
lxvii.	August 6 - - -	4	—
lxviii.	„ 13 - -	5	—
lxix.	„ 20 - -	6	—
lxx.	„ 27 - -	2	—
		219	14

Monthly incidence.

The monthly record was—

1891.			1892.		
—	Cases.	Deaths.	—	Cases.	Deaths.
May - - -	1	—	January - -	20	—
June - - -	3	—	February - -	31	3
July - - -	—	—	March - -	36	8
August - -	—	—	April - - -	33	1
September - -	1	—	May - - -	31	1
October - -	—	—	June - - -	26	1
November - -	1	—	July - - -	14	—
December - -	5	—	August - -	17	—
	11	—		208	14

Sex and

Of this number 121 were males and 98 females, the fatal attacks amounting among the former to eight, among the latter to six.

They were distributed according to their ages as follows :—

TABLE LXV.

—	Males.		Females.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year -	4	2	—	—	4	2
1 to 5 years - -	12	1	10	1	22	2
5 to 10 years - -	17	2	15	1	32	3
10 to 15 years -	12	—	12	—	24	—
15 to 20 years -	10	—	15	1	25	1
20 to 30 years -	31	3	27	1	58	4
30 to 40 years -	19	—	9	1	28	1
40 to 50 years -	10	—	5	—	15	—
50 to 60 years -	1	—	3	1	4	1
60 to 70 years -	3	—	—	—	3	—
70 and over - -	—	—	—	—	—	—
Age not ascertained	2	—	2	—	4	—
	121	8	98	6	219	14

or stated in age periods :—

—	Cases.	Deaths.	Case Mortality.
			Per cent.
Under 1 year - -	4	2	50·
1 to 10 years - -	54	5	9·
10 to 30 - -	107	5	4·6
30 and upwards - -	50	2	4·1

The mortality on the whole number only amounted to 6·4 per cent.

Occu
tions

Occupations.—The occupations of those who were attacked with small-pox are set forth in the accompanying tables. They are collected under three categories, viz., (*a*) those who lived all day at home, engaged in home occupations or in trade carried on at their houses. This class includes of course all the infants; (*b*) those who were in daily attendance at school, returning home to meals ; (*c*) those who were engaged in occupations for the greater part of the day away from their home as rag-sorters, weavers, menders, &c. who mostly come home for the midday meal. The incidence of the disease on these several classes is illustrated in Chart VI.

TABLE LXVI.

OCCUPATION TABLE.—MALES.

—	Under 1 Year.	1 to 10 Years	10 to 30 Years	30 Years and over.	Age not ascertained.	Total.
AT HOME - - - -	4	10	4	8	1	27
Of no occupation - - -	4	10	2	2	1	19
Butcher - - - -				1		1
Gasfitter - - - -			1			1
Joiner - - - -				1		1
Innkeeper - - - -				1		1
Painter - - - -				1		1

Occupation Table.—Males—*continued.*

—	Under 1 Year.	1 to 10 Years	10 to 30 Years	30 Years and over.	Age not ascertained.	Total.
Plumber				1		1
Shop assistant			1			1
Wheelwright				1		1
AT SCHOOL	—	19	7	—	—	26
AT WORK	—	—	42	25	1	68
Mill hand			10	6		16
Miner			14	4		18
Agent			1			1
Baker			1			1
Barber			1			1
Butcher			1			1
Carrier			1			1
Carter				1		1
Clerk (L. Y. R.)			1			1
Confectioner				1		1
Engineer				1		1
Fish dealer			1			1
Labourer			1	1		2
Maltster				1		1
Mason				3		3
Painter			2	1		3
Potman			1			1
Rag merchant			2			2
Sanitary inspector				1		1
Shop assistant			2			2
Watchman				1		1
Occupation not ascertained			3	4	1	8

Occupation Table.—Females.

—	Under 1 Year.	1 to 10 Years	10 to 30 Years	30 Years and over.	Age not ascertained.	Total.
AT HOME	—	10	22	15	2	49
Of no occupation	—	10	6	1	—	17
Housewife	—	—	14	13	2	29
Domestic servant			2			2
Dressmaker				1		1
AT SCHOOL		15	7			22
AT WORK			25	2		27
Mill hand			15	1		16
Rag sorter			5	1		6
Domestic servant			1			1
Dressmaker			1			1
Milliner			1			1
School teacher			2			2

Type of Attack.

Small-pox in districts other than Batley and Dewsbury, 1891-2. Type of disease.

The type of the attack of small-pox from which these 219 patients suffered was as follows :—

—	Cases.	Per cent.
Confluent	42	19·1
Coherent	18	8·2
Discrete	78	35·6
Mild	74	33·8

and in 7 cases no information could be obtained on this head, two of them being fatal attacks.

At different age-periods these proportions are :—

—	Cases.		Per cent.
Under 1 year of age		4	—
Confluent	1		25·
Mild	2		50·
Type not known	1		—
From 1 to 10 years		54	—
Confluent	14		25·4
Coherent	2		3·6
Discrete	8		16·3
Mild	29		52·7
Type not known	1		—
From 10 to 30 years		107	—
Confluent	22		20·4
Coherent	10		10·2
Discrete	44		40·
Mild	29		27·7
Type not known	2		—
At 30 years upwards		50	—
Confluent	4		8·3
Coherent	6		10·4
Discrete	25		52·1
Mild	14		27·1
Type not known	1		—

At ages not ascertained there were—Confluent, one case; discrete, one case, and in two cases the type was not known.

Isolations of cases.

From the data already furnished in the description of each of these districts it will be remembered that three of the early cases were sent for isolation to the Dewsbury Union Workhouse at Staincliffe (viz., from Birstal, Heckmondwike, and Soothill Upper). Of the rest there were sent to—

(*a.*) Dewsbury Small-pox Hospital			92
(*b.*) Batley	,,	,,	17
(*c.*) Morley	,,	,,	36
(*d.*) Ossett	,,	,,	20
(*e.*) Leeds	,,	,,	2

Thus there were 48 cases left for treatment in their own homes, and one sent to Ravensthorpe Sewage Works (*see* Chart VIII.).

The analysis of the foregoing as regards age and sex is as follows :—

Small-pox in districts other than Batley and Dewsbury, 1891-2.

TABLE LXVII.

ISOLATION of SMALL-POX CASES.

(Chart VIII.)

—	Sent to								Remained at Home.			
	Workhouse.				Hospital.							
	Male.		Female.		Male.		Female.		Male.		Female.	
	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.	C.	D.
Under 1 year -					1	1	—	—	3	1	—	—
1 to 5 years -					9	1	10	1	3	—	—	—
5 to 10 years -					14	2	12	1	3	—	3	—
10 to 15 „ -			1	—	11	—	8	—	1	—	3	—
15 to 20 „ -			1	—	8	—	12	1	2	—	2	—
20 to 30 „ -					26	3	20	—	5	—	7	1
30 to 40 „ -					13	—	5	—	6	—	4	1
40 to 50 „ -	1	—			6	—	3	—	3*	—	2	—
50 to 60 „ -					1	—	3	1	—	—	—	—
60 to 70 „ -					2	—	—	—	1	—	—	—
70 and over -					—	—	—	—	—	—	—	—
Age not ascertained.					2	—	1	—	—	—	1	—
	1	—	2	—	93	7	74	4	27	1	22	2

* One isolated at Ravensthorpe Sewage Works.

Invaded households.

The total number of houses invaded by small-pox during this period was 159, and the months of their "invasion," together with the number of cases arising in the households may be seen in the following table :—

TABLE LXVIII.

INCIDENCE of SMALL-POX in HOUSEHOLDS.

Month in which First Case arose.	Total Number of Houses invaded.	Number of Cases per House.							Per-centage Proportion of Houses having Multiple Cases.
		1.	2.	3.	4.	5.	6.	7.	
1891.									Per cent.
May - - -	1	1							—
June - - -	3	3							—
July - - -	—								
August - - -	—								
September - - -	1	1							—
October - - -	—								
November - - -	1	1							—
December - - -	4	2	1	1					50·
1892.									
January - - -	12	7	4	1					41·6
February - - -	26	21	3	2					19·2
March - - -	30	23	6	1					23·3
April - - -	27	21	3	2	1				25·
May - - -	20	16	3	1					20·
June - - -	13	6	2	4				1	53·8
July - - -	7	5	1	1					28·5
August - - -	14	13	—	1					7·1
	159	120	23	14	1	—	—	1	

From this table it is seen that cases of small-pox came from 159 different houses, there being one case in each of 120 houses, two cases each in 23 houses, three cases each in 14 houses, four cases in one house, and seven cases in one house.

Particulars of the inmates of 147 houses, yielding 205 cases, were obtained on personal inquiry, the total number of inmates being 828.

Of the houses not visited, or of whose inmates no particulars were obtained, in—

10 there was 1 case per house or 10 cases in all.
2 „ were 2 cases „ „ 4 „ „
12 14

The distribution of the cases in the households of various sizes was as follows :—

TABLE LXIX.

Number of Houses.	Inmates per House.	Cases per House.							Total.	
		1.	2.	3.	4.	5.	6.	7.	Inmates.	Cases.
4	11	4							44	4
5	10	4		1					50	7
7	9	6						1	63	13
10	8	6		3	1				80	19
23	7	15	4	4					161	35
23	6	14	7	2					138	34
24	5	20	1	3					120	31
27	4	21	5	1					108	34
16	3	14	2						48	18
8	2	6	2						16	10
147		110	21	14	1	—	—	1	828	205

Thus in—

Households (No. of Members).	Single Cases.	Multiple.
	Per cent.	Per cent.
11	100·	—
10	80·	20·
9	85·	14·3
8	60·	40·
7	65·2	34·8
6	60·9	39·1
5	83·3	16·6
4	77·7	22·2
3	100·	—
2	100·	—

In the description of each district a table has been given showing the number of inmates (and of those attacked) in each house, grouped in age-periods.

The facts there given may be collated in the following comparison of the ages of all the inmates of the households visited, with those of them who contracted small-pox :—

Small-pox in districts other than Batley and Dewsbury, 1891-2.

——	Inmates.	Cases.	Proportion of those Attacked.
Under 1 year -	21	4	
	21	4	19 per cent. (under 1 year).
1 to 5 years -	84	22	
5 to 10 „ -	91	31	
	175	53	30·8 per cent. (1 to 10 years).
10 to 15 „ -	104	22	
15 to 20 „ -	118	23	
20 to 30 „ -	169	55	
	391	100	25·7 per cent. (10 to 30 years).
30 to 40 „ -	87	28	
40 to 50 „ -	82	13	
50 to 60 „ -	40	4	
60 to 70 „ -	19	3	
70 and over -	3	—	
	231	48	20 per cent. (30 years upwards).
Age not ascertained.	10	—	

Stated in per-centages of the whole numbers of each series (viz., inmates 828, cases 205), the following is the comparison between those living at ages in houses visited and those attacked in like age-periods :—

——	Inmates.	Cases.
	Per cent.	Per cent.
Under 1 year - - -	2·5	2· (nearly).
1 to 10 years - - -	21·1	26·3
10 to 30 years - - -	47·3	49·2
30 and over - - -	27·7	22·4
Ages not ascertained - -	1·2	—

SINGLE and MULTIPLE CASES with respect to ISOLATION.

Of the 120 households in which only a single case occurred, the patient was kept at home during the period of illness in 18, and removed to hospital in 102.

Of the 39 households in which two or more cases occurred, the "initial cases" (and sometimes the later cases also) were kept at home in 14, removed to hospital in 34.

The particulars as to date of attack, appearance of rash, and of removal to hospital in these cases are given in the subjoined lists, which may be thus summarised :—

A.—INITIAL CASES retained at HOME.

Houses with Single Cases.			Houses with Multiple Cases.			
Number of Houses.	Cases.	Other Inmates.	No. of House.	Initial.	Later.	Other Inmates.
15	15	63	12	20	17	38
No details, 3	3	—	2	1	1	—

B.—INITIAL CASES removed to HOSPITAL.

Houses with Single Cases.			Houses with Multiple Cases.			
Number of Houses.	Cases.	Other Inmates.	No. of House.	Initial.	Later.	Other Inmates.
95	95	440	25	34	4	82
No details, 7	7	—	—	—	—	—

Dealing only with those houses of which details were obtained it appears from these figures that the attack-rate (*i.e.*, the proportion of those attacked to the whole number of the household) was in the case of—

Single cases retained at home - - 19·2 per cent.
„ „ removed to hospital - 17·7 „ „

and that of the cases in houses where more than one occurred, which arose subsequently to the "initial cases":—
Initial cases retained at home - - 30·9 per cent.
„ „ removed to hospital - 22·6 „ „

TABLE LXX.

A. 1.

LIST OF HOUSEHOLDS in which a SINGLE CASE of SMALL-POX occurred and remained at home.

Reference to House Register.	No. of Inmates.	Reference to Case Register.	Date of Onset.	Date of Rash.
T. 10 - - -	2	5	Feb. 22 -	Feb. 25.
H. 12 - - -	3	19	Mar. 14 -	Mar. 17.
T. 4 - - -	3	4	Feb. 21 -	Feb. 23.
L. 1 - - -	4	6	„ 6 -	„ 9.
S. N. 2 - -	4	3	„ 18 -	„ 20.
S. U. 5 - -	4	19	Apr. 5 -	Apr. 7.
S. U. 14 - -	4	2	Jan. 7 -	Jan. 10.
S. U. 4 - -	5	6	Feb. 4 -	Feb. 8.
L. 3 - - -	6	2	Jan. 14 -	Jan. 17.
S. U. 2 - -	6	20	Apr. -	Apr. 10.
S. U. 7 - -	6	14	Mar. 20 -	Mar. 23.
S. U. 19 - -	6	27	May 16 -	May 17.
L. 2 - - -	8	7	Feb. 1 -	Feb. 3.
L. 4 - - -	8	1	Dec. 28 -	Dec. 30.
S. U. 6 - -	9	17	Mar. 24 -	Mar. 28.

HOUSEHOLDS of which NUMBER OF MEMBERS not ascertained.

District.	—	Reference to Case Register.	Date of Onset.	Date of Rash.
Birstal - -	—	5	Feb. 15 -	Feb. 18
Liversedge - -	—	5	„ 2 -	„ 5
Liversedge - -	—	8	„ 29 -	Mar. 3

Small-pox in districts other than Batley and Dewsbury, 1891–2.

TABLE LXXI.

A 2.

HOUSEHOLDS in which MULTIPLE CASES occurred, the INITIAL CASES being treated at HOME.

House Reference.	Number of Inmates.	Initial Cases.			Later Cases.				—
		Re-ference.	Date of Onset.	Date of Rash.	Re-ference.	Date of Onset.	Day of Attack of Initial Case.	Removed to Hospital.	
L. 5	7	3	Jan. 16	Jan. 20	4	Jan. 29	14th	—	
SU. 15	4	4	Jan. 16	Jan. 19	5	Jan. 31	16th	—	
H. —	—	5	Jan. 17						
		6	Jan. 17						
SU. 9	4	8	Feb. 11	Feb. 15	23	Feb. 22	12th	—	
Mi. —	—	6	April 11		7	April 22	12th	May 1.	
L. 7	6	12	June 13	June 16	9	June 29	17th	—	
B. 1	4	2	Dec. 9	Dec. 12		Jan. 12	35th	—	
					4	Jan. 15	38th	—	
H. 15		10	Feb. 7	Feb. 9	12	Feb. 26	20th	—	
	7				13	Feb. 26	20th	—	
H. 4		11	Feb. 24	March 1	14	March 6	12th	March 12.	
	5				15	March 6	12th	March 12.	
Mo. 11		29	April 17	April 17	12	May 9	23rd	May 14.	
	6				13	May 9	23rd	May 14.	
Mo. 8		28	April 17	April 17	11	May 9	23rd	May 13.	
	7				14	May 14	28th	May 16.	
L. 6		9	June 10	June 13.					
	8	10	June 11	June 13.					
		11	June 11	June 13.					
H. 13		29	April 12	April 18	30	April 29	18th	May 4.	
	8				31	April 29	18th	May 3.	
					35	May 18	37th	May 21.	
L. 8		13	June 24	June 27.					
		14	June 24	June 27.					
	9	15	June 24	June 27.					
		16	June 25	June 28.					
		17	June 25	June 28.					
		18	June 27	June 30.					
		20	July 1	July 4.					

Small-pox in districts other than Batley and Dewsbury, 1891-2.

TABLE LXXII.

B. 1.

HOUSEHOLDS in which a SINGLE CASE of SMALL-POX occurred and was removed to HOSPITAL.

Reference to House Register.	No. of Inmates.	Case.			
		Reference to Case Register.	Date of Rash.	Date of Removal.	Day of Attack on which removed.
B. 2	2	9	April 3	April 3	3rd.
O. 7	„	7	Feb. 10	Feb. 10	3rd.
O. 9	„	5	„ 9	„ 9	4th.
O. 15	„	15	May 27	May 30	8th.
R. 3	„	6	April 6	April 7	4th.
H. 1	3	18	March 15	March 18	7th.
H. 10	„	21	„ 19	„ 21	7th.
H. 11	„	25	„ 30	April 1	6th.
H. 21	„	36	May 19	May 21	5th.
Mi. 5	„	11	Aug. 13	Aug. 14	5th.
Mi. 7	„	9	„ 5	„ 7	6th.
Mo. 2	„	3	March 19	March 20	4th.
O. 14	„	19	June 22	June 23	5th.
O. 17	„	16	May 28	May 29	6th.
R. 13	„	17	Aug. 24	Aug. 25	3rd.
S.N. 1	„	1	Jan. 30	Feb. 6	11th.
T. 5	„	9	?	March 6	5th.
H. 5	4	20	March 21	„ 21	4th.
H. 14	„	3	Jan. 2	Jan. 9	10th.
Mi. 2	„	1	March 1	March 5	8th.
Mo. 10	„	30	July 19	July 19	3rd.
Mo. 16	„	36	?	Aug. 10	4th.
O. 3	„	9	Feb. 21	Feb. 21	4th.
O. 4	„	2	Sept. 15	Sept. 15	5th.
R. 1	„	4	March 18	March 23	9th.
R. 12	„	10	May 9	May 11	4th.
S.N. 4	„	4	Feb. 28	Feb. 29	5th.
S.N. 6	„	7	April 20	April 21	5th.
S.N. 7	„	9	„ 25	„ 28	6th.
S.N. 9	„	2	Jan. 30	Feb. 6	10th.
S.U. 10	„	7	Feb. 10	„ 13	6th.
S.U. 13	„	11	March 18	March 18	7th.
S.U. 17	„	22	April 24	April 27	7th.
T. 2	„	15	„ 4	„ 4	4th.
H. 8	5	22	March 26	March 26	5th.
H. 13	„	2	Jan. 5	Jan. 7	5th.
H. 16	„	7	„ 21	„ 21	7th.
H. 17	„	32	May 3	May 4	4th.
H. 23	„	40	Aug. 20	Aug. 22	6th.
Mo. 4	„	4	April 6	April 8	7th.
Mo. 5	„	6	„ 11	„ 14	7th.
Mo. 20	„	31	July 19	July 19	2nd.
Mo. 22	„	41	?	Aug. 29	3rd.
O. 1	„	8	Feb. 25	Feb. 25	3rd.
O. 8	„	6	?	„ 11	3rd.
O. 12	„	14	May 17	May 18	6th.
O. 16	„	18	June 7	June 8	6th.
R. 8	„	12	May 22	May 22	3rd.
S.N. 12	„	13*	June 20	June 9	—
S.U. 1	„	9	March 6	March 7	6th.
S.U. 16	„	1	June 14	June 15	5th.
T. 3	„	14	March 30	April 4	10th.
T. 16	„	19	Aug. 16	Aug. 19	6th.
H. 6	6	34	May 5	May 6	5th.
H. 19	6	28	April 20	April 23	6th.
Mi. 1	„	4	„ 17	„ 20	5th.
Mi. 3	„	3	„ 7	„ 9	6th.
O. 10	„	11	„ 17	„ 18	4th.
O. 11	„	20	Aug. 5	Aug. 5	4th.
S.N. 8	„	6	April 6	April 9	8th.
T. 1	„	13	March 28	March 30	5th.
T. 7	„	6	„ 1	„ 2	6th.
T. 9	„	11	„ 12	„ 12	3rd.
B. 4	7	6	„ 10	„ 10	4th.
B. 5	„	10	April 6	April 7	3rd.
H. 20	„	34	May 5	May 6	5th.
H. 22	„	39	July 25	July 27	6th.
Mi. 4	„	2	March 15	March 15	2nd.
Mi. 6	„	12	Aug. 12	Aug. 15	7th.
Mo. 3	„	5	April 7	April 11	8th.
O. 2	„	10	Feb. 29	Feb. 29	4th.
O. 13	„	17	June 4	June 6	7th.
R. 14	„	16	Aug. 23	Aug. 23	4th.
S.N. 5	„	8	April 23	April 25	6th.
S.U. 8	„	13	March 20	March 27	10th.
T. 8	„	12	„ 8	„ 18	14th.
T. 14	„	16	May 7	May 8	4th.
T. 15	„	17	„ 10	„ 11	5th.
Mo. 21	8	32	July 25	July 25	3rd.
S.N. 11	„	12	May 27	May 28	5th.
T. 13	„	10	March 3	March 8	8th.
Mi. 9	„	8	Aug. 6	Aug. 8	7th.
Mi. 8	9	10	„ 10	„ 12	6th.
O. 5	„	1	May 20	May 20	2nd.
R. 4	„	5	April 6	April 7	5th.
R. 6	„	1	Nov. 6	Nov. 6	4th.
S.N. 10	„	10	May 2	May 4	7th.
R. 5	10	2	Feb. 11	Feb. 13*	8th.
R. 7	„	15	June 3	June 4	4th.
S.N. 3	„	5	March 17	March 19	5th.
T. 17	„	20	Aug. 16	Aug. 20	7th.
Mo. 17	11	15	May 29	May 29	4th.
R. 11	„	8	„ 9	„ 10	4th.
S.U. 4	„	3	Jan. 19	Jan. 19	4th.
T. 11	„	7	March 2	March 3	5th.

* Infected in hospital.

HOUSEHOLDS of which NUMBER of MEMBERS not ascertained.

District.	Case.			
	Reference to Case Register.	Date of Rash.	Date of Removal.	Day of Attack on which removed.
Birstal	1	June 16	June 16	5th.
Heckmondwike	1	?	„ 20	8th.
Heckmondwike	37	June 13	„ 18	8th.
Mirfield	5	April 27	April 28	5th.
Soothill Nether	11	May 3	May 3	2nd.
Soothill Nether	14	June 17	June 27	15th.
Thornhill	18	July 20	July 21	5th.

* Isolated at the Sewage Works.

Small-pox in districts other than Batley and Dewsbury, 1891-2.

TABLE LXXIII.

B. 2.

LIST of HOUSEHOLDS in which MULTIPLE CASES of SMALL-POX occurred and were removed to HOSPITAL.

House Reference.	No. of Inmates.	Initial Cases.				Later Cases.				—
		Reference.	Date of Rash.	Date of Removal.	Day of Attack on which Removed.	Reference.	Date of Onset.	Day of Attack of Initial Cases.	Date of Removal.	
T. 12	4	1	Dec. 9	Dec. 19	13th	2	Dec. 28	22nd	Jan. 1.	
Mo. 7	6	1	Jan. 18	Jan. 21	6th	2	Jan. 25	10th	Jan. 29.	
O. 6	7	3 4	Feb. 8 Feb. 8	Feb. 8 Feb. 8	3rd. 3rd.					
T. 6	3	3	Feb. 18	March 4	18th	8	Feb. 26	11th	March 4.	
H. 7	5	16 17	March 11 March 12	March 15 March 15	7th. 6th.					
R. 2	4	3	March 18	March 19	4th	9	May 9		May 12.	
B. 3	2	7 8	March 23 March 29	March 31 March 31	10th. 3rd.					
SU. 11	7	18	March 30	April 1	6th	21	April 10	15th	April 17.	
H. 2	2	26	March 31	April 2	6th	38	June 16		June 21.	
H. 9	6	27	March 31	April 1	4th	33	April 16	19th	April 21.	
Mo. 1	6	7	April 13	April 17	7th	8	April 20	10th	April 23.	
Mo. 6	3	9	April 28	April 29	3rd	10	May 8	12th	April 29.	
R. 9	6	7	May 3	May 4	4th	11	May 19	19th	May 21.	
O. 18	7	12 13	May 8 May 11	May 10 May 12	7th. 6th.					
R. 10	6	13 14	May 29 May 31	May 30 June 1	4th. 4th.					
Mo. 18	6	16	June 13	June 13	3rd	25	July 2	22nd	July 2.	
Mo. 14	4	23	July 4	July 4	2nd	37	July 20	17th	July 22.	
H. 3	10	4	Jan. 19	Jan. 21	6th	8 9	Jan. 28 Jan. 28	13th 13th	— —	
S.U. 12	6	10	March 14	March 18	8th	15 16	March 24 March 24	14th 14th	— March 28.	
S.U. 18	8	24	May 27	May 23	7th	25 26	May 30 June 9	14th 24th	June 4. June 13.	
Mo. 12	5	17 18 19	June 21 June 21 June 21	June 21 June 21	4th. 4th.					

Small-pox in districts other than Batley and Dewsbury. 1891-2.

LIST of HOUSEHOLDS, &c.—*continued*,

House Reference.	No. of In-mates.	Initial Cases.				Later Cases.				—
		Re-ference.	Date of Rash.	Date of Removal.	Day of Attack on which Removed.	Re-ference.	Date of Onset.	Day of Attack of Initial Cases.	Date of Removal.	
Mo. 13 -		20	June 25 -	June 25 -	3rd -	22	July 4 -	12th -	July 3.	
	5	21	June 29 -	June 29 -	3rd.					
Mo. 9 - -		24	June 30 -	June 30 -	2nd -	26	July 13 -	16th -	July 14.	
	8					27	July 14 -	17th -	July 14.	
Mo. 15 -		33	July 27 -	July 27 -	4th -	38	August 8 -	16th -	August 11.	
	7	34	July 26 -	July 26 -	2nd.					
Mo. 19 -		35	August 4 -	August 6 -	4th -	39	August 19 -	17th -	August 20.	
	7					40	August 19 -	17th -	August 20.	

It will be observed that of the households in which "multiple" cases occurred, the dates of their occurrence were so near together in some as to cause them all to be regarded as "initial" cases, *i.e.*, probably exposed to a common source of infection. Eliminating these there are of such house-holds in which the "initial case" remained at home, 11 instead of 14; and of those in which the "initial" cases were removed to hospital, 19 instead of 25. It is important to remember this in endeavouring to estimate the value of hospital isolation, which may be done by comparing the two series of "single" and "multiple" cases with regard to the day of attack on which the "initial case" was removed to hospital.

TABLE LXXIV.

DAYS of REMOVAL to HOSPITAL of INITIAL CASES.

Day of Attack on which removed.	Single Cases in 95 Houses. Number of Inmates.										Multiple Cases in 19 Houses. Number of Inmates.								
	2	3	4	5	6	7	8	9	10	11	2	3	4	5	6	7	8	10	—
2nd day - -	—	—	—	1	—	1	—	1	—	—	—	—	1	1	—	1	1	—	—
3rd " - -	2	1	1	4	1	1	1	—	—	—	—	1	—	2	1	—	—	—	—
4th " - -	2	1	5	1	2	4	—	1	1	3	—	—	1	—	2	—	—	—	—
5th " - -	—	4	3	3	3	2	1	1	1	1	—	—	—	—	—	—	—	—	—
6th " - -	—	3	2	5	3	2	—	1	—	—	1	—	1	—	1	1	—	1	—
7th " - -	—	2	2	3	—	2	1	1	1	—	—	—	—	—	1	—	1	—	—
8th " - -	1	—	1	—	1	1	1	—	1	—	—	—	—	—	1	—	—	—	—
9th " - -	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10th " - -	—	—	2	1	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—
11th " - -	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
13th " - -	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—
14th " - -	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—
18th " - -	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
	5	12	17	18	10	15	4	5	4	4	1	2	4	3	6	2		1	—
Acquired in Hospital -				1															
Per cent. - -	5·3	12·7	18·1	19·1	10·6	16·	4·2	5·3	4·2	4·2	4·7	9·5	19·	14·3	28·5	9·5	9·5	4·7	—

Small-pox in districts other than Batley and Dewsbury, 1891–2.

As might be expected, there was a larger proportion of multiple than of single cases in the larger households, and as to the day of attack on which the initial case was removed this table shows that—

In 94 Houses having Single Cases (94 Cases).			In 19 Houses having Multiple Cases (21 initial Cases).		
—	Cases.	Per cent.	—	Cases.	Per cent.
Case removed on 2nd day.	3	3·1	Initial case removed on 2nd day.	4	19·
Case removed on 3rd day.	11	11·7	Initial case removed on 3rd day.	4	19·
Case removed on 4th day.	20	21·2	Initial case removed on 4th day.	3	14·2
Case removed on 5th day.	19	20·2			
Case removed on 6th day.	16	17·	Initial case removed on 6th day.	5	23·8
Case removed on 7th day.	12	12·7	Initial case removed on 7th day.	2	9·5
Case removed on 8th day.	6	6·3	Initial case removed on 8th day.	1	4·7
Case removed on 9th day.	1	1·			
Case removed on 10th day.	4	4·2			
Case removed on 11th day.	1	1·			
			Initial case removed on 13th day.	1	4·7
Case removed on 14th day.	1	1·			
			Initial case removed on 18th day.	1	4·7

In other words in the households in which no second case occurred after the removal of the patient, this removal took place in 81, or in 86·1 *per cent.*, before the 8th day; whilst in the 19 houses in which cases occurred subsequent to the removal of 21 cases, this removal took place in 18, or 85·7 per cent., before the 8th day of the attack of small-pox—a difference too slight to be appreciable.

Comparison as to occupation of inmates of infected houses.

Comparison of Occupations of those attacked and not attacked:—Of the 828 persons inhabiting 147 houses invaded by small-pox there were—

315 living at home or engaged in home work.
163 attending school.
350 engaged daily in work away from home.

Of those attacked with small-pox there were—

71 at home, or 22·6 per cent.
45 at school, or 27·4 per cent.
89 at work, or 25·4 per cent.

The same series analysed according to the size of the households gives—

Table LXXV.

Number of Inmates per House.	Number of Houses.	Total Inmates.			Total Cases.		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
11	4	15	12	17	2	1	1
10	5	14	14	22	2	1	4
9	7	25	14	24	5	2	6
8	10	27	17	36	5	7	7
7	23	61	33	67	11	8	16
6	23	51	28	59	12	10	12
5	24	46	25	49	9	7	15
4	27	48	18	42	11	8	15
3	16	19	2	27	8	1	9
2	8	9	—	7	6	—	4
	147	315	163	350	71	45	89

In Chart XIII. and in the following list information is given of the occupations under these heads of the members of every one of these households, those attacked being indicated by the numerals which refer to them in the case register.

Table LXXVI.

List of Invaded Houses (grouped according to number of Inmates) giving the Number in each of Three Classes of Occupation.

(See also Chart XIII.)

District.	Reference to House List.	All Inmates.			Attacked with Small-pox (Numerals refer to Case Register).		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
Birstal - -	2	1		1	9		
Ossett - -	7	1		1	7		
" - -	9	1		1			5
" - -	15	1		1			15
Ravensthorpe -	3	1		1	6		
Thornhill -	10	1		1			5
Birstal - -	3	2			7, **8**		
Heckmondwike -	2	1		1	26		33
Heckmondwike -	1	1		2			**18**
" -	10	1		2	21		
" -	11	2		1	25		
" -	12	2		1	19		
" -	21	1	1	1	36		
Mirfield - -	5	1		2			11
" - -	7	2		1	9		
Morley - -	2			3			**3**
Ossett - -	14	1		2			19
" - -	17	1		2			16
Ravensthorpe -	13			3			17
Soothill Nether -	1	2		1			1
Thornhill - -	4			3			**4**
" - -	5	2		1			9
Morley - -	6	2		1	9, 10		
Thornhill - -	6	1	1	1	8	3	
Heckmondwike -	5	1		3			**20**
" -	14	2		2			3
Liversedge -	1	3		1			6
Mirfield - -	2	1		3			1
Morley - -	10	1	1	2	30		
" - -	16	2	1	1		36	
Ossett - -	3	2	1	1			9
" - -	4	3		1			2
Ravensthorpe -	1	1	2	1			4
" -	12	2	1	1		10	
Soothill Nether -	2	1		3			5
" " -	4	2		2			4
" " -	6		1	3			7
" " -	7	2	2		9		
" " -	9	1		3			2
Soothill Upper -	5	1	2	1		19	
" " -	10	1	1	2		**7**	
" " -	13	3		1			11
" " -	14	1	2	1	2		
" " -	17	3		1	22		
Thornhill - -	2	4			15		
Morley - -	14	1	2	1		23, 37	
Ravensthorpe -	2	2	1	1	3		
Soothill Upper -	9	3		1	8, **23**		
" " -	15	1	1	2		5	4
Thornhill - -	12	1		3	2		1
Birstal - -	1	3		1	3, 4		2
Heckmondwike -	8	1	1	3		22	

LIST of INVADED HOUSES, &c.—*continued.*

District.	Reference to House List.	All Inmates.			Attacked with Small-pox (Numerals refer to Case Register).		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
Heckmondwike	13	2		3			2
„	16	4		1			7
„	17	1	1	3			32
„	23	1	3	1		40	
Morley	4	1		4			4
„	5	1		4			6
„	20	2		3	30		
„	22	1	3	1		41	
Ossett	1	1	3	1			8
„	8	2	1	2			6
„	12	2	1	2	14		
„	16	2		3			18
Ravensthorpe	8	1	3	1			12
Soothill Nether	12	2	2	1		13	
Soothill Upper	1	2	2	1			9
„ „	4	1	1	3			6
„ „	16	2		3			7
Thornhill	3	2		3			14
„	16	4		1	19		
Heckmondwike	7	3	1	1	17	16	
„	4	1	2	2	14	**15**	11
Morley	12	4		1	18, 19		17
„	13	3	1	1	21, 22	20	
Heckmondwike	6	3	2	1			24
„	19	2	2	2		28	
Liversedge	3	3	2	1			2
Mirfield	1	2		4			4
„	3	3	1	2		3	
Ossett	10	2		4	11		
„	11	2		4			20
Soothill Nether	8	1	1	4		6	
Soothill Upper	2	1		5	20		
„ „	7	1	2	3		14	
„ „	19	2	1	3		21	
Thornhill	1	4	1	1		**13**	
„	7	2	1	3			6
„	9	2		4	11		
Heckmondwike	9	2	1	3			21, 33
Liversedge	7	3	2	1	19	12	
Morley	1	2	2	2	8		7
„	7	3	2	1	1	2	
„	18	3	1	2	16, 25		
Ravensthorpe	9	2	3	1	11		7
„	10	3	2	1	14	13	
Morley	11	1	1	4			12, 13, 29
Soothill Upper	12	2	1	3	**10,** 15	16	
Birstal	4	5	2			6	
„	5	1	2	4			10
Heckmondwike	20	2	2	3			34
„	22	1	2	4		39	
Mirfield	4	2		5			**2**
	6	2	3	2			12
Morley	3	2	1	4			5
Ossett	2	3	2	2			10
,	13	2	2	3			17

LIST of INVADED HOUSES, &c.—*continued.*

Small-pox in districts other than Batley and Dewsbury, 1891-2.

District.	Reference to House List.	All Inmates.			Attacked with Small-pox (Numerals refer to Case Register).		
		At Home.	At School.	At Work.	At Home.	At School.	At Work.
Ravensthorpe	14	3		4			16
Soothill Nether	5	1	1	5			8
Soothill Upper	8	3	3	1	**13**		
Thornhill	8	3	2	2			12
„	14	2		5			**16**
„	15	3	1	3	17		
Liversedge	5	5	1	1	3, 4		
Ossett	6	2	2	3		4	3
„	18	6		1	12, 13		
Soothill Upper	11	2	2	3	18		21
Heckmondwike	15	2	1	4	10, 13	12	
Morley	8	2		5			11, 14, 28
„	15	3	3	1		33, 34, 38	
„	19	4	1	2	35, 39	40	
Liversedge	2	3		5			7
„	4	1	3	4			
Morley	21	3	3	2		32	
Soothill Nether	11	1	3	4		12	
Thornhill	13	3		5			10
Liversedge	6	4		4	10		9, 11
Morley	9	5	3			24, 26, 27	
Soothill Upper	18	2	2	4	25, 26	24	
Heckmondwike	18	3	3	2	**30,** 31	35	29
Mirfield	9	2		6			5
Mirfield	8	1	4	4			10
Ossett	5	8		1			1
Ravensthorpe	4	1	3	5			5
„	6	3	1	5			1
Soothill Nether	10	3	2	4			10
Soothill Upper	6	4	2	3			17
Liversedge	8	5	2	2	13, 16, 17, **18,** 20.	14, 15	
Ravensthorpe	5	4	3	3			2
„	7	1	3	6			15
Soothill Nether	3	1	2	7			
Thornhill	17	5	4	1	20		
Heckmondwike	3	3	2	5	8	9	4
Morley	17	3	3	5		15	
Ravensthorpe	11	3	4	4	8		
Soothill Upper	3	4	2	5			3
Thornhill	11	5	3	3	7		
147 houses		315	163	350	71	45	9

Small-pox in districts other than Batley and Dewsbury, 1891–2.

SUPPLEMENTARY LIST OF CASES IN HOUSEHOLDS of whom no further particulars were obtained.

ATTACKED WITH SMALL-POX.

(Numerals refer to Case-Registers.)

District.	At Home.	At School.	At Work.
Birstal - - - - -			1
„ - - - - -	5		
Heckmondwike - - -		1	
„ - - -	5·6		
„ - - -			37
Liversedge - - - -			5
„ - - - - -	8		
Mirfield - - - -			5
„ - - - - -	6		7
Soothill Nether - - -			11
„ - - -		14	
Thornhill - - - -		18	
12 houses - - - -	5	3	6

Vaccination data.

Dealing in like manner with the households having single and those having multiple cases in order to ascertain whether in the one group or the other there was any marked predominance of one or other class of persons in these several "occupation classes"; and analysing them according as to whether the patients remained at home or were sent to hospital, we find the following—

110 Households having Single Cases.

Occupation.	Attacked and Remained at Home.	Not Attacked.	Attacked and Removed to Hospital.	Not Attacked.
At home - -	3	22	21	172
At school - -	3	12	16	86
At work - -	9	29	58	182
	15	63	95	440

37 Households having Multiple Cases.

Occupation.	Attacked.		Not Attacked.	Attacked.		Not Attacked.
	Initial Case (Remained at Home).	Later Cases.		Initial Case (Removed to Hospital).	Later Cases.	
At home - -	9	9	15	17	12	35
At school -	3	4	6	10	9	14
At work - -	8	4	17	7	3	33
	20	17	38	34	24	82

The "Attack-rates" that may be calculated from these data show that the relative proportions of those "at home" and "at work" are reversed in the single case households and in those of the multiple series (reckoning only the "initial" cases in the latter), showing that the larger proportion of the former group were engaged in duties away from home, whilst, where other persons in the house were attacked, the majority of those first taken ill were engaged in duties at their homes.

PROPORTIONAL ATTACK OF INITIAL CASES (all HOUSEHOLDS).

—	Single Cases in House.		Multiple in House.	
	Cases.	Per cent.	Cases.	Per cent.
At home - -	26	21·6	29	50·8
At school - -	22	18·3	13	22·8
At work - -	72	60·8	15	26·3
	120		57	

A different and perhaps more accurate line of comparison may be made by getting the actual "attack rate" in respect to the whole number in the house, when it will be seen that in the "single" series the greatest incidence is among those engaged at work, whether removed to hospital or not, whereas in the multiple series (exclusive of the initial cases) the rates are much lower among this class than either the other two.

SMALL-POX ATTACK RATES.

Occupation.	Cases Remaining at Home.		Initial Cases sent to Hospital.	
	"Single" Group.	"Multiple" Group (excluding Initial Cases).	"Single" Group.	"Multiple" Group (excluding Initial Cases).
	Per cent.	Per cent.	Per cent.	Per cent.
At home - -	12·	37·5	10·8	25·5
At school - -	20·	40·	15·7	39·1
At work - -	23·7	19·	24·7	8·3

Single multip cases i househ

Vaccination in Relation to Small-pox.—Of the total number (219) cases of small-pox which occurred in the districts of the union—other than Dewsbury and Batley—there were:—

A. Vaccinated 145, of whom two died.
B. Alleged to have been vaccinated, but having no no marks, six.
C. Undergoing vaccination when attacked with small-pox, eight, of whom one died.
D. Unvaccinated 60, of whom 11 died.

The mortality in each of the above classes was therefore:—

A.	Vaccinated - - - - -	1·3 per cent.
B.	Alleged vaccination - - -	*nil.*
C.	"Under" vaccination - -	12·5 per cent.
D.	Unvaccinated - - -	16·6 „

In the accompanying table and diagram (Chart XIV.) the weekly incidence of each of the above classes is indicated.

TABLE LXXVII.

WEEKLY INCIDENCE of SMALL-POX in OTHER DISTRICTS of UNION than BATLEY and DEWSBURY, according to VACCINATION. RELATION of those ATTACKED.

No. of Week of Outbreak.	Vaccinated.		"Alleged" Vaccination.		"Under" Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
iv.	1	—	—	—	—	—	—	—	1	—
v.	—	—	—	—	—	—	—	—	—	—
vi.	—	—	—	—	—	—	—	—	—	—
vii-	2	—	—	—	—	—	1	—	3	—
. . . .										
xx.	—	—	—	—	—	—	1	—	1	—
. . . .										
xxviii.	—	—	—	—	—	—	1	—	1	—
. . . .										
xxxiii.	1	—	—	—	—	—	1	—	2	—
. . . .										
xxxvi.	2	—	—	—	—	—	1	—	3	—
xxxvii.	2	—	—	—	—	—	—	—	2	—
xxxviii.	3	—	1	—	—	—	5	—	9	—
xxxix.	2	—	—	—	—	—	—	—	2	—
xl.	3	—	—	—	1	—	2	—	6	—
xli.	8	—	1	—	—	—	—	—	9	—
xlii.	4	—	—	—	—	—	1	1	5	1
xliii.	3	—	—	—	—	—	1	—	4	—
xliv.	9	1	1	—	—	—	2	1	12	2
xlv.	4	—	—	—	—	—	2	—	6	—
xlvi.	3	—	1	—	—	—	5	3	9	3
xlvii.	4	—	1	—	—	—	4	3	9	3
xlviii.	6	—	—	—	—	—	3	1	9	1
xlix.	6	—	—	—	1	1	2	—	9	1
l.	7	—	—	—	—	—	1	—	8	—
li.	7	—	—	—	—	—	—	—	7	—
lii.	5	—	—	—	—	—	4	—	9	—
liii.	3	—	—	—	1	—	1	1	5	1
liv.	7	—	—	—	—	—	2	1	9	1
lv.	6	—	—	—	—	—	2	—	8	—
lvi.	3	—	—	—	—	—	3	—	6	—
lvii.	5	—	—	—	—	—	—	—	5	—
lviii.	3	—	1	—	—	—	1	—	5	—
lix.	5	—	—	—	—	—	1	—	6	—
lx.	2	—	—	—	—	—	4	—	6	—
lxi.	7	—	—	—	—	—	1	—	8	—
lxii.	5	1	—	—	1	—	—	—	6	1
lxiii.	1	—	—	—	1	—	—	—	2	—
lxiv.	2	—	—	—	—	—	—	—	2	—
lxv.	2	—	—	—	1	—	3	—	6	—
lxvi.	2	—	—	—	—	—	—	—	2	—
lxvii.	3	—	—	—	—	—	1	—	4	—
lxviii.	4	—	—	—	—	—	1	—	5	—
lxix.	2	—	—	—	2	—	2	—	6	—
lxx.	1	—	—	—	—	—	1	—	2	—
	145	2	6	—	8	1	60	11	219	14

Analysed with respect to age, the cases fall into the groups given in the following table (and also in Chart X.) :—

Small-pox in districts other than Batley and Dewsbury. 1891-2.

TABLE LXXVIII.

VACCINATION and SMALL-POX.

AGES of the ATTACKED and their VACCINATION RELATIONS.

Age and vaccination.

—	Vaccinated.		Alleged Vaccination.		"Under" Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year - -	—	—	—	—	2	1	2	1	4	2
1 to 5 years - -	9	—	—	—	4	—	9	2	22	2
5 to 10 „ - -	13	—	—	—	2	—	17	3	32	3
10 to 15 „ - -	13	—	2	—	—	—	9	—	24	—
15 to 20 „ - -	14	—	2	—	—	—	9	1	25	1
20 to 30 „ - -	46	1	1	—	—	—	11	3	58	4
30 to 40 „ - -	27	1	—	—	—	—	1	—	28	1
40 to 50 „ - -	15	—	—	—	—	—	—	—	15	—
50 to 60 „ - -	2	—	1	—	—	—	1	1	4	1
60 to 70 „ - -	3	—	—	—	—	—	—	—	3	—
70 years and over - -	—	—	—	—	—	—	—	—	—	—
Age not ascertained -	3	—	—	—	—	—	1	—	4	—
	145	2	6	—	8	1	60	11	219	14

or grouped in age-periods :—

—	Under 1 Year.		1 to 10 Years.		10 to 30 Years.		30 and over.		Age not ascertained.		Total.	
Vaccinated -	—	—	22	—	73	1	47	1	3	—	145	2
Alleged vaccination	—	—	—	—	5	—	1	—	—	—	6	—
Under vaccination.	2	1	6	—	—	—	—	—	—	—	8	1
Unvaccinated -	2	1	26	5	29	4	2	1	1	—	60	11
	4	2	54	5	107	5	50	2	4	—	219	14

Type of disease and vaccination.

Of the relations between the *type* of the attack of small-pox, and the condition of the patients in respect to vaccination, the following is a summary analysis (see also Chart XI.) :—

TABLE LXXIX.

TYPE of SMALL-POX.

—	Confluent.	Coherent.	Discrete.	Mild.	Type not ascertained.
Vaccinated - - -	3	11	62	64	5
Alleged vaccination - -	3	2	1	—	—
"Under" vaccination -	3	—	—	5	—
Unvaccinated - - -	33	5	15	5	2

These figures are too small to permit of any satisfactory deductions to be made from them, but for the purpose of contrast with the other similar series, the following per-centages may be cited :—

(*a.*) Among the *vaccinated* about 2 per cent. had confluent small-pox, 7·5 per cent. coherent, 42 per cent. discrete, 44·1 per cent. mild attacks.

(*b.*) Among the *unvaccinated* 55 per cent. had confluent small-pox, 4·3 per cent. coherent, 25 per cent. discrete, 4·3 per cent. mild.

And conversely :—

(*a.*) Of the *confluent* cases, 7·1 per cent. were vaccinated, 78·5 per cent. unvaccinated.

(*b.*) Of the *coherent* cases, 61·1 per cent. were vaccinated, 27·7 per cent. unvaccinated.

Small-pox in districts other than Batley and Dewsbury, 1891-2.

(*c.*) Of the *discrete* cases, 79·5 per cent. were vaccinated, 19·2 per cent. were unvaccinated.

(*d.*) Of the *mild* cases, 86·5 per cent. were vaccinated, 6·7 per cent. were unvaccinated.

Comparison as to vaccination of inmates of infected houses.

Comparing the vaccination conditions of the 828 inmates of the 147 houses visited during the inquiry with that of those among them who were attacked with small-pox we find—

At all ages, of 828 inmates—
650 were vaccinated, or 79·7 per cent.
12 were alleged to have been vaccinated.
17 were undergoing vaccination.
127 were unvaccinated, or 15·3 per cent.,

and in 22 no information on the point could be obtained.

In the same households amongst the 205 cases of small-pox there were—

135 were vaccinated, or 65·8 per cent.
6 were alleged to have been vaccinated.
8 were undergoing vaccination.
56 were unvaccinated, or 26·8 per cent.

(*See* subjoined Lists of Households and Chart XV.)

The actual numbers at each age-period were—

—	Vaccinated.	Alleged Vaccination.	Under Vaccination.	Unvaccinated.	No information on Vaccination.
Under 1 year.					
Inmates - - -	2	—	5	14	—
Cases - - - -	—	—	2	2	—
1 to 10 years.					
Inmates - - -	107	1	8	56	3
Cases - - - -	22	—	6	25	—
10 to 30 years.					
Inmates - - -	331	6	4	43	7
Cases - - - -	68	5	—	27	—
30 years and upwards.					
Inmates - - -	205	5	—	14	7
Cases - - - -	45	1	—	2	—
Age not ascertained.					
Inmates - - -	5	—	—	—	5
Cases - - - -	—	—	—	—	—

Assuming that these individuals were all equally exposed to the chances of infection, these figures show :—

1st. That of the *vaccinated* class, the proclivity to attack between 1 and 10 years was 1 : 4·6 ; between 10 and 30 years was 1 : 4·8 ; at 30 years and upwards was 1 : 4·7.

2nd. That of the *unvaccinated* class, the proclivity under one year of age was 1 : 7 ; between one year and 10 years, 1 : 2·1 ; from 10 to 30 years, 1 : 1·6 ; at 30 and upwards, 1 : 7.

3rd. That the general proclivity of all classes at "under" one year was - - 1 : 5·2.
One to 10 years - - - 1 : 3·2.
10 to 30 years - - - 1 : 3·8.
30 years and upwards - - 1 : 5.

4th. As regards the other classes, at all ages the proclivity amongst those of "alleged" vaccination was 1 : 2 ; of those "under" vaccination was 1 : 2·3.

Previous small-pox.

A previous attack of small-pox had been experienced by 34 of those individuals, viz., four who came into the "10 to 30 years" period and 30 into the "30 upwards" period. Again, two of the patients suffered from a second attack of the disease. Of these individuals, 20 were known to have been vaccinated (including one of the "cases"), 11 unvaccinated (including the other "case"), and in three no information as to vaccination was obtainable. If one may assume that those who have been vaccinated are on the same plane as to liability to infection as those who had previously had small-pox then the proportions above given may be modified thus :—.

	Vaccinated or previous Small-pox.		Neither Vaccinated nor previously had Small-pox.	
10 to 30 years.				
Inmates - -	336	or 1 : 4·8	41	or 1 : 1·5
Cases - - -	70		26	
30 years upwards.				
Inmates - -	214	1 : 5	5	or 1 : 2·5
Cases - - -	43		2	

Vaccinat and limita-tion of spread of disease.

Lastly, as to the influence of vaccination in limiting the spread of small-pox in a household, the following data may be given.

GROUP A.—INITIAL CASES REMAINED at HOME.

—	Single Cases in House.		Multiple Cases in House.		
	At-tacked.	Not At-tacked.	Attacked.		Not At-tacked.
			Initial.	Later.	
Vaccinated - - -	14	59	17	9	34
Re-vaccinated. before house infected.	—	2	—	—	—
Re-vaccinated. on or after house infected.	—	29	—	—	10
Previous small-pox -		1		1	1
Under vaccination - -	—	—	1	—	2
Alleged vaccination - -	—	1	1	1	—
No information as to vaccination.	—	1	—	—	—
Unvaccinated - -	1	2	1	7	2
Previous small-pox -		1			

GROUP B.—INITIAL CASES REMOVED to HOSPITAL.

—	Single Cases in House.		Multiple Cases in House.		
	At-tacked.	Not At-tacked.	Attacked.		Not At-tacked.
			Initial.	Later.	
Vaccinated - - -	59	354	21	15	68
Re-vaccinated. before house infected.	—	1	—	—	1
Re-vaccinated. on or after house infected.	—	66	—	1	35
Previous small-pox -		13			4
Under vaccination - -	—	2	2	5	5
Alleged vaccination - -	—	5	—	—	—
No information as to vaccination.	4	20	—	—	1
Previous small-pox -		3			8
Unvaccinated - -	32	59	11	4	1
Previous small-pox -	1	8			

Working out the attack rates of these various groups one finds that in group A. the attack rate amongst the *vaccinated* class in households yielding a single case is 19·1 per cent.; amongst the *unvaccinated*, it is 33·3 per cent., or deducting the one who had small-pox in childhood 50 per cent. Secondly, dealing with the houses in which multiple cases occurred, and calculating only those which occurred later than the cases regarded as "initial," the rate amongst the *vaccinated* was 20·9 per cent. amongst the *unvaccinated*, 77·7 per cent.

In Group B. the attack rate of single cases was 14·2 per cent.; of the multiple series (later cases only), 18 per cent. amongst the *vaccinated*, whilst amongst the *unvaccinated*, the attack rate of single cases was 64·8 per cent., or deducting those who had had small-pox primarily, 71 per cent.; and of the multiple (later) cases, 38·3 per cent., or deducting the one who had small-pox primarily, 36·3 per cent.

TABLE LXXX.

"OTHER DISTRICTS."

LIST of HOUSEHOLDS in GROUPS according to the NUMBER of MEMBERS, with VACCINATION DATES of the MEMBERS, and those ATTACKED with SMALL-POX.

Reference to House List.	All Inmates.					Attacked with Small-pox. (Nos. refer to the Case Register.)			
	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
B. 2 - -	2					9			
O. 7 - -	2					7			
O. 9 - -	2					5			
O. 15 - -	2					15			
R. 3 - -	2					6			
T. 10 - -	2					5			
B. 3 - -	1		1			7	**8**		
H. 2 - -	2					26, 33			
H. 1 - -		2			1				**18**
H. 10 - -	1	1			1				21
H. 11 - -	2			1		25			
H. 12 - -	3					19			
H. 21 - -	2				1	36			
Mi. 5 - -	3					11			
Mi. 7 - -	3					9			
Mo. 2 - -	2			1				3	
O. 14 - -	3					19			
O. 17 - -	3					16			
R. 13 - -	3					17			
S.N. 1 - -	2				1				1
T. 4 - -	2	1				**4**			
T. 5 - -	1	1			1				9
Mo. 6 - -	1	1	1			10	9		
T. 6 - -	1				2	8			3
H. 5 - -	3				1				**20**
H. 14 - -	3				1				3
L. 1 - -	4					6			
Mi. 2 - -	4					1			
Mo. 10 -	4					30			
Mo. 16 -	4					36			
O. 3 - -	2				2	9			
O. 4 - -	3				1				2
R. 1 - -	1	3				4			
R. 12 - -	3				1				10
S.N. 2 - -	4					3			
S.N. 4 - -	4					4			
S.N. 6 - -	1	3				7			
S.N. 7 - -	4					9			
S.N. 9 - -	4					2			
S.U. 5 - -	3				1	19			
S.U. 10 -	2			1	1				**7**
S.U. 13 -	2				2	11			
S.U. 14 -	4					2			
S.U. 17 -	1	1		1	1				22
T. 2 - -	4					15			
Mo. 14 -	3		1			23	37		
R. 2 - -	2				2	3			9
S.U. 9 - -	2					8			**23**
S.U. 15 -	2			2				4, 5	
T. 12 - -	2		1		1	2			1

LIST OF HOUSEHOLDS, &c.—*cont.*

Small-pox in districts other than Batley and Dewsbury, 1891-2.

Reference to House List.	All Inmates.					Attacked with Small-pox. (Nos. refer to the Case Register.)			
	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
B. 1 - -	2		1		1	2, 3			4
H. 8 - -	4				1				22
H. 13 - -	3	2				2			
H. 16 - -	3		1		1				7
H. 17 - -	1			1	3				32
H. 23 - -	4				1				40
Mo. 4 - -	3				2				4
Mo. 5 - -	5					6			
Mo. 20 -	4				1				31
Mo. 22 -	3				2				41
O. 1 - -	3				2	8			
O. 8 - -	5					6			
O. 12 - -	5					14			
O. 16 - -	4				1	18			
R. 8 - -	5					12			
S.N. 12 -	2	1			2				13
S.U. 1 - -	2				3	9			
S.U. 4 - -	4			1		6			
S.U. 16 -	5					7			
T. 3 - -	3				2	14			
T. 16 - -	1				4				19
H. 7 - -	3				2	17			16
H. 4 - -	2				3	11			14, **15**
Mo. 12 -	3				2	17			18, 19
Mo. 13 -	4		1			20, 21	22		
H. 6 - -	6					24			
H. 19 - -	4				2				28
L. 3 - -	6					2			
Mi. 1 - -	6					4			
Mi. 3 - -	6					3			
O. 10 - -	4	2				11			
O. 11 - -	6					20			
S.N. 8 - -	4				2				6
S.U. 2 - -	6					20			
S.U. 7 - -	6					14			
S.U. 19 -	5				1				27
T. 1 - -	2	1			3				**13**
T. 7 - -	3	2			1	6			
T. 9 - -	6					11			
H. 9 - -	5				1	27 33			
L. 7 - -	5				1	19			12
Mo. 1 - -	6					7, 8			
Mo. 7 - -	3		1		2		2		1
Mo. 18 -	6					16, 25			
R. 9 - -	5				1	7. 11			
R. 10 - -	4				2	13			14
Mo. 11 -	6					12, 13, 29			
S.U. 12 -	4				2	16			**10**, 15
B. 4 -	6			1				6	
B. 5 -	7					10			
H. 20 - -	5				2	34			
H. 22 - -	4				3				
Mi. 4 - -	5		1		1				**2**
Mi. 6 - -	6				1				12

Small-pox in districts other than Batley and Dewsbury, 1891-2.

List of Households, &c.—*cont.*

Reference to House List.	All Inmates.					Attacked with Small-pox. (Nos. refer to the Case Register.)			
	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
Mo. 3 - -	7					5			
O. 2 - -	4			1	2			10	
O. 13 - -	6				1	17			
R. 14 - -	7					16			
S.N. 5 - -	6				1				8
S.U. 8 - -	4				3				**13**
T. 8 - -	3				4				12
T. 14 - -	5				2				**16**
T. 15 - -	6				1	17			
L. 5 - -	7					3, 4			
O. 6 - -	7					3, 4			
O. 18 - -	7					12, 13			
S.U. 11 -	7					18, 21			
H. 15 - -	6				1	10, 12			13
Mo. 8 - -	7					11, 14, 28			
Mo. 15 -	7					33, 34, 38			
Mo. 19 -	2		4		1		39, 40		35
L. 2 - -	8					7			
L. 4 - -	8					1			
Mi. 9 - -	8					8			
Mo. 21 - -	7				1	32			
S.N. 11 -	8					12			
T. 13 - -	7				1	10			
L. 6 - -	7		1			9, 10, 11			
Mo. 9 - -	8					24, 26, 27			
S.U. 18 -	5				3	25			24, 26
H. 18 - -	6				2	29, 31			**30**, 35
Mi. 8 - -	6				3	10			
O. 5 - -	8	1				1			
R. 4 - -	8				1				5
R. 6 - -	7				2				1
S.N. 10 -	9					10			
S.U. 6 -	8				1	17			

List of Households, &c.—*cont.*

Reference to House List.	All Inmates.					Attacked with Small-pox. (Nos. refer to the Case Register.			
	Vaccinated.	No Information as to Vaccination.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.	Vaccinated.	"Under" Vaccination.	Alleged Vaccination.	Unvaccinated.
L. 8 - -	8		1			13, 14, 15, 16, 17, **18**	20		
R. 5 - -	9				1	2			
R. 7 - -	9			1				15	
S.N. 3 -	10					5			
T. 17 - -	8				2	20			
H. 3 - -	6		2		2	8			4, 9
Mo. 17 -	9				2	15			
R. 11 - -	8			1	2	5			
S.U. 3 - -	4				7				3
T. 11 - -	11					7			
147 houses -	650	22	17	12	127	135	8	6	56

Supplementary List of Households.

Vaccination Data of those Attacked with Small-pox.

District.	Vaccinated.	Unvaccinated.
Birstal - - - -	1	
" - - - - -	5	
Heckmondwike - -		1
" - - -	5, 6	
" - - -	37	
Liversedge - - -	5	
" - - -	8	
Mirfield - - -	5	
" - -	6	7
Soothill Nether - -	11	
" - - - -		14
Thornhill - - -		18
12 houses - - -	10	4

PART IV.

Vaccination and small-pox.

Vaccination in relation to Small-pox.

Distribution of all cases of small-pox according to age, sex, and occupation. Vaccination date of the small-pox cases. Class I. Vaccinated:—Age and sex distribution. Analysis of number, foveation and area of vaccination marks. Fatal cases—list of. Small-pox in re-vaccinated subjects. Class II. No information as to vaccination:—Age and sex distribution. Class III. Alleged vaccination:—Age and sex distribution. Class IV. Under vaccination:—Age and sex distribution. List of cases. Class V. Unvaccinated:—Age and sex distribution. List of cases of small-pox in unvaccinated infants. Comparison of the vaccinated with the unvaccinated classes. Analysis of invaded households as to vaccination of those attacked and those not attacked with small-pox. Influence of vaccination on the incidence of small-pox in households. Comparisons of households yielding single with those having multiple cases of small-pox. Vaccination and measures of isolation as means of protection against further attacks. Type of small-pox in relation to the vaccination condition of those attacked. Confluent type:—Age distribution. Coherent type:—Age distribution. Discrete type:—Age distribution. Fatal cases. Mild type:—Age distribution. Unvaccinated cases. Type uncertain:—Summary analysis. Type of disease amongst the vaccinated class, in reference to the quality and number of vaccination scars.

In this section I propose to collate the information respecting vaccination in relation to small-pox which has been derived from the three main sources described above, in order that as large a mass of material as possible may be available for statistical deductions. By means of diagrams (XVI. to XX.) I have endeavoured to convey these statistical details so that they become more easily grasped, the figures upon which they are based being all given in the text.

In the first place it may be useful to recapitulate the particulars of the 1,029 cases as to their incidence upon the various sexes and classes, and after that to discuss in turn each of the groups formed to describe their condition as to vaccination, and lastly to analyse these groups with reference to the type of small-pox with which they were attacked.

The total number of cases of small-pox were distributed accordiug to *sex and age* as follows:—

—	Male.		Female.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths
Under 1 year	14	7	15	12	29	19
1 to 5 years	38	11	44	11	82	22
5 to 10 „	50	9	62	7	112	16
10 to 15 „	58	2	52	1	110	3
15 to 20 „	88	4	91	5	179	9
20 to 30 „	132	12	140	9	272	21
30 to 40 „	85	5	55	5	140	10
40 to 50 „	34	6	25	1	59	7
50 to 60 „	11	2	15	1	26	3
60 to 70 „	5	—	4	—	9	—
70 years and over	2	—	2	—	4	—
Age not ascertained	4	—	3	—	7	—
Total	521	58	508	52	1,029	110

And grouped as to *occupation*:—

—	At Home.		At School.		At Work.		Workhouse Inmates.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	29	19	—	—	—	—	—	—	29	19
1 to 10 years	82	22	112	16	—	—	—	—	194	38
10 to 30 „	112	8	61	—	382	22	6	3	561	33
30 years and upwards	113	10	—	—	125	10	—	—	238	20
Age not ascertained	4	—	—	—	3	—	—	—	7	—
Total	340	59	173	16	510	32	6	3	1,029	110

Of the total number—1,029—cases of small-pox, the disease occurred in—

627, who were vaccinated, of whom 16 died;
10, of whose vaccination history no information could be obtained;
25, who were alleged to have been vaccinated but who presented no unequivocal scars, of whom two died;
21, who at the time of being attacked with small-pox were undergoing primary vaccination, of whom three died;
346, who were unvaccinated, of whom 89 died.

The mortality on the whole number was 10·7 per cent., and for each of the above classes—

Vaccinated	2·5 per cent.
Alleged vaccination	8· „
Under vaccination	14·3 „
Unvaccinated	25·7 „

N.B.—Excluding infants under one year of age these figures would be considerably modified, namely.—

Vaccinated—626 cases; 16 deaths; mortality, 2·5 per cent.
Alleged vaccination—25 cases; 2 deaths, mortality, 8 per cent.
"Under" vaccination—14 cases; 0 deaths.
Unvaccinated—325 cases; 73 deaths; mortality, 22·4 per cent.

and the general case mortality would be reduced (1,000 cases, 91 deaths) to 9·1 per cent.

Vaccination and small-pox.

TABLE LXXXI.

VACCINATION DATA OF CASES OF SMALL-POX.

—	Vaccinated.		No Information as to Vaccination.		Alleged Vaccination.		"Under" Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases,	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	1	—	—	—	—	—	7	3	21	16	29	19
1 to 5 years	16	—	2	—	—	—	6	—	58	22	82	22
5 to 10 „	27	1	2	—	1	—	4	—	78	15	112	16
19 to 15 „	65	—	—	—	4	—	2	—	39	3	110	3
15 to 20 „	96	2	1	—	6	—	1	—	75	7	179	9
20 to 30 „	210	3	2	—	7	1	1	—	52	17	272	21
30 to 40 „	126	7	—	—	3	—	—	—	11	3	140	10
40 to 50 „	48	1	3	—	1	1	—	—	7	5	59	7
50 to 60 „	22	2	—	—	2	—	—	—	2	1	26	8
60 to 70 „	8	—	—	—	—	—	—	—	1	—	9	—
70 years and over	2	—	—	—	1	—	—	—	1	—	4	—
Age not ascertained	6	—	—	—	—	—	—	—	1	—	7	—
Total	627	16	10	—	25	2	21	3	346	89	1,029	110

These may be grouped in age-periods, thus:—

—	Under 1 Year.		1 to 10 Years.		10 to 30 Years.		30 Years and upwards.		Age not ascertained.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Vaccinated	1	—	43	1	371	5	206	10	6	—	627	16
No information	—	—	4	—	3	—	3	—	—	—	10	—
Alleged vaccination	—	—	1	—	17	1	7	1	—	—	25	2
"Under" vaccination	7	3	10	—	4	—	—	—	—	—	21	3
Unvaccinated	21	16	136	37	166	27	22	9	1	—	346	89
Total	29	19	194	38	561	33	238	20	7	—	1,029	110

Explanation of Chart XVI.:—

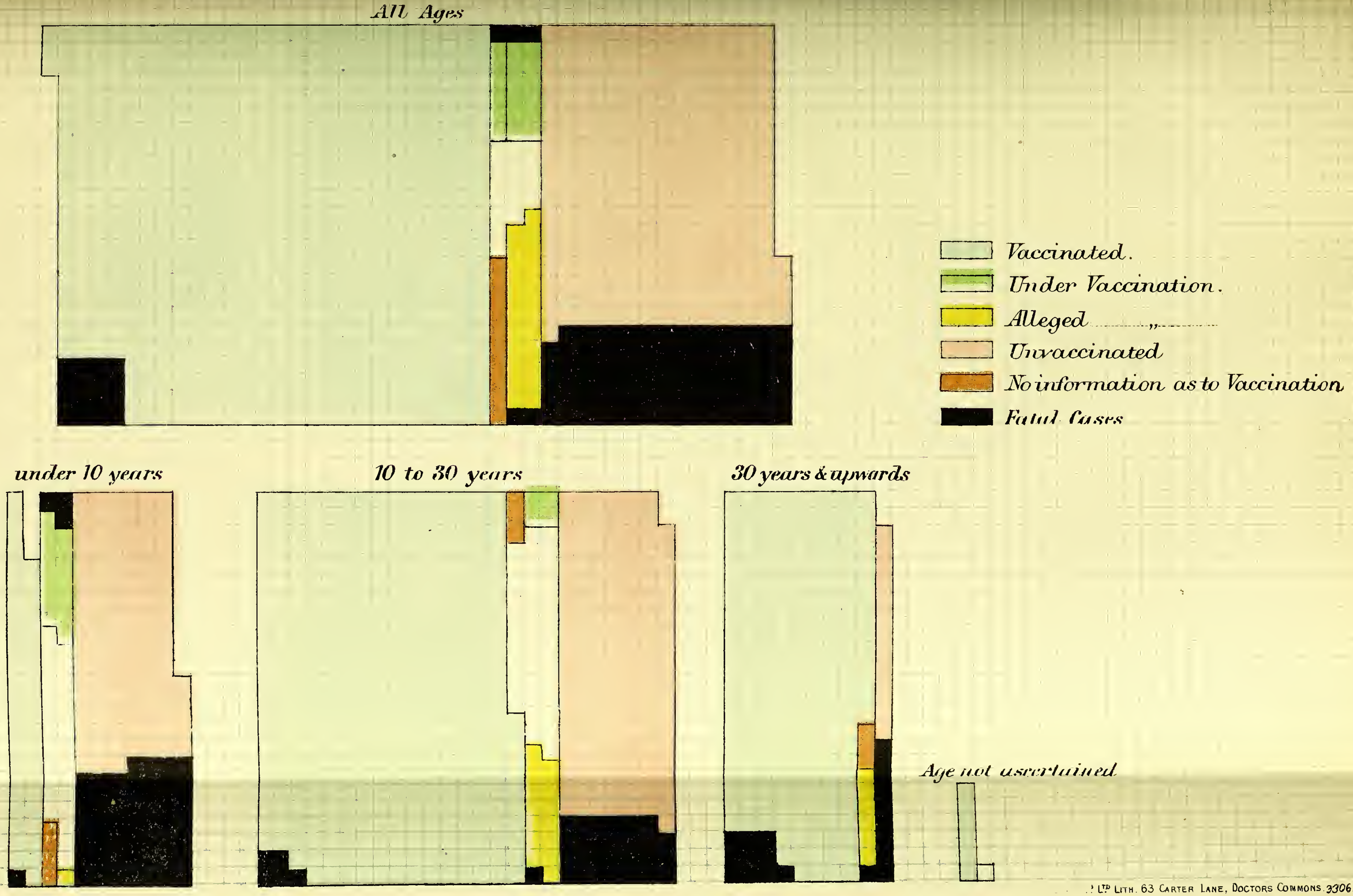
This chart illustrates the same facts as those depicted in Chart X.—i.e., *the incidence of small-pox and its mortality upon the various classes of vaccinated and unvaccinated people.*

It further analyses the cases according to their age distribution in the three periods, "under 10 years," "10 to 30 years," "30 years and over." It may suffice to repeat here in tabular form the facts thus portrayed.

CASES OF SMALL-POX IN ALL DISTRICTS.

—	*Vaccinated.*		*No Information as to Vaccination.*		*"Under" Vaccination.*		*"Alleged" Vaccination.*		*Unvaccinated.*	
	Cases.	*Deaths.*	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*	*Cases.*	*Deaths.*
At all ages	*627*	*16*	*10*	—	*21*	*3*	*25*	*2*	*346*	*89*
At ages—										
Under 10 years	*44*	*1*	*4*	—	*17*	*3*	*1*	—	*158*	*58*
10 to 30 years	*371*	*5*	*3*	—	*4*	—	*17*	*1*	*165*	*27*
30 years and over	*206*	*10*	*3*	—	—	—	*7*	*1*	*22*	*9*
Age unknown	*6*	—	—	—	—	—	—	—	*1*	—

DISTRIBUTION OF ALL CASES OF SMALL POX AS REGARDS VACCINATION.



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LTD LITH. 63 CARTER LANE, DOCTORS COMMONS. 3306.4

Table LXXXIII.

Cases with Primary Vaccination Cicatrix or Cicatrices Present.

Area of Cicatrix or Cicatrices.

—	Class A^1=half and upwards of one-half square inch total area.																			
	Number of Scars.																			
	Four or more.				Three.				Two.				One.				Not recorded.			
	Foveation of Scars.																			
	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.
Under 1 year	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 to 5 years	—	—	1	—	1	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—
5 to 10 „	2	—	—	—	5	—	2	—	1	—	—	—	—	—	—	—	—	—	—	—
10 to 15 „	2	—	—	—	13	7	4	—	2	—	2	2	—	—	—	—	—	—	—	—
15 to 20 „	3	1	—	—	17	2	4	2	8	—	1	2	—	—	—	—	—	—	1	—
20 to 30 „	9	—	—	—	29	5	3	2	26	4	4	2	4	—	—	1	—	—	—	2
30 to 40 „	2	1	1	—	5	2	7	1	15	2	3	1	5	—	—	1	—	—	—	1
40 to 50 „	1	—	—	—	2	1	—	—	6	—	3	—	—	—	—	—	—	—	—	—
50 to 60 „	2	—	—	—	1	—	—	—	1	2	—	1	—	—	—	—	—	—	—	—
60 to 70 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
70 and over	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Age not ascertained	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	21	2	2	—	73	17	23	5	59	8	13	8	9	—	—	2	—	—	1	3
	25				118				88				11				4			
	246																			

—	Class^2=one-third, but less than one-half square inch in the total area.																			
	Number of Scars.																			
	Four or more.				Three.				Two.				One.				Not recorded.			
	Foveation of Scars.																			
	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.
Under 1 year	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 to 5 years	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5 to 10 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10 to 15 „	—	—	—	—	—	—	1	—	2	—	2	—	1	—	1	—	—	—	—	—
15 to 20 „	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
20 to 30 „	—	—	—	—	2	—	—	—	5	—	—	—	—	—	2	—	—	—	—	—
30 to 40 „	—	—	—	—	—	—	1	—	3	1	—	—	—	—	—	—	—	—	—	—
40 to 50 „	—	—	—	—	—	—	—	—	1	—	1	—	1	—	—	—	—	—	—	—
50 to 60 „	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
60 to 70 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
70 and over	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Age not ascertained	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	2	—	2	—	12	1	3	—	3	—	4	—	—	—	—	—
	—				4				16				7				—			
	27																			

—	Class A^3=less than one-third square inch total area.																			
	Number of Scars.																			
	Four or more.				Three.				Two.				One.				Not recorded.			
	Foveation of Scars.																			
	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.
Under 1 year	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
1 to 5 years	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
5 to 10 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10 to 15 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15 to 20 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
20 to 30 „	—	—	—	—	—	—	—	—	3	—	1	—	—	—	—	—	—	—	—	—
30 to 40 „	—	—	—	—	—	—	1	—	—	—	3	—	3	—	—	—	—	—	—	—
40 to 50 „	—	—	—	—	—	—	—	—	—	—	1	—	1	—	—	—	—	—	—	—
50 to 60 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
60 to 70 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
70 and over	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Age not ascertained	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Total	—	—	—	—	—	—	1	—	3	—	5	—	5	—	3	—	—	—	—	—
	—				1				8				8				—			
	17																			

—	Class^4=areas not recorded.																			
	Number of Scars.																			
	Four or more.				Three.				Two.				One.				Not recorded.			
	Foveation of Scars.																			
	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.
Under 1 year	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 to 5 years	—	—	—	—	2	—	—	—	—	—	2	—	—	—	—	1	—	—	—	5
5 to 10 „	2	—	—	—	2	—	—	—	—	—	1	1	—	—	—	—	—	—	—	11
10 to 15 „	2	—	1	—	3	1	1	3	1	—	1	2	—	—	1	—	—	—	—	9
15 to 20 „	4	—	—	—	12	1	2	2	3	—	2	1	—	—	—	1	1	—	1	25
20 to 30 „	2	1	—	2	23	—	1	12	10	—	3	5	3	—	—	—	2	—	—	42
30 to 40 „	1	—	—	1	11	—	2	3	4	1	5	7	1	—	—	—	4	—	1	26
40 to 50 „	—	—	—	—	4	—	—	1	3	—	4	1	—	—	—	—	2	—	—	15
50 to 60 „	—	—	—	1	—	—	1	—	1	—	1	2	—	—	—	—	2	—	—	6
60 to 70 „	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	1	3
70 and over	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
Age not ascertained	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—	—	4
Total	11	1	1	4	57	2	7	21	23	1	20	19	4	—	2	2	12	—	3	147
	17				87				63				8				162			
	337																			

—	Total Vaccinated Cases.	Deaths amongst Vaccinated Cases.				
		Class A^1.	Class A^2.	Class A^3.	Class A^4.	Total Deaths amongst Vaccinated Cases.
Under 1 year	1	—	—	—	—	—
1 to 5 years	16	—	—	—	—	—
5 to 10 „	27	—	—	—	1	1
10 to 15 „	64	—	—	—	—	—
15 to 20 „	97	—	1	—	1	2
20 to 30 „	210	—	—	—	3	3
30 to 40 „	126	2	—	1	4	7
40 to 50 „	48	—	—	—	1	1
50 to 60 „	22	1	—	—	1	2
60 to 70 „	8	—	—	—	—	—
70 and over	2	—	—	—	—	—
Age not ascertained	6	—	—	—	—	—
Total	—	3	1	1	11	—
	627					16

Vaccination and small-pox.

Class I.—Vaccinated.

In the class of the "vaccinated" are comprised 627 cases, 319 of whom were males, eight cases being fatal, 308 females, eight fatal:—

Table LXXXII.

—	Male.		Female.		Total.		Proportion to whole number in Age Periods.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
							Per cent.	Per cent.
Under 1 year	—	—	1	—	1	—	—	—
	—	—	—	—	1	—	0·16	—
1 to 5 years	8	—	8	—	16	—	—	—
5 to 10 „	12	1	15	—	27	1	—	—
	—	—	—	—	43	1	7·01	6·25
10 to 15 years	32	—	33	—	65	—	—	—
15 to 20 „	45	—	51	2	96	2	—	—
20 to 30 „	100	1	110	2	210	3	—	—
	—	—	—	—	371	5	59·1	31·25
30 to 40 years	77	3	49	4	126	7	—	—
40 to 50 „	26	1	22	—	48	1	—	—
50 to 60 „	10	2	12	—	22	2	—	—
60 to 70 „	5	—	3	—	8	—	—	—
70 years and over	1	—	1	—	2	—	—	—
	—	—	—	—	206	10	32·7	62·5
Age not ascertained	3	—	3	—	6	—	—	—
	319	8	308	8	627	16	—	—

Number and quality of Vaccination Scars.

Particulars of the number and character of the marks produced by primary vaccination were obtained in 480 instances, amongst the 627 vaccinated persons who contracted small-pox, but these particulars did not in all instances refer to each of the several points concerned. Thus the *number* of scars is recorded in 461 instances, not recorded in 166; the character as to *foveation* is recorded in 416, not recorded in 211; whilst the total *area* of the scars is only recorded in 290, not recorded in 337. The circumstances under which the observations had to be made must account for the inability to obtain a complete record, as only a small proportion of the whole number attacked could be seen in hospital, and the absence from home on the occasion of our visits of many of those who had been attacked previous to the inquiry further explains deficiencies in the record. As regards those individuals whose homes were not visited, or who had removed from the districts, I am indebted for certain particulars *quâ* vaccination to the several medical officers of health.

The data thus obtained are presented in tabular form in Table LXXXIII. under the several age periods used in this report. I propose to offer a few remarks upon each of these heads.

Number of vaccination scars.

Of the 461 persons of whom we have records as to the total number of scars, 11 died, or 2·3 per cent.

Having 4 or more marks—42 ; 1 died, or 2·3 per cent.
„ 3 „ „ 210 ; none died
„ 2 „ „ 175 ; 10 „ 5·7 „
„ 1 „ „ 34 ; none „

And as regards age, the fatal case amongst those having four or more marks was aged 30 to 40; whilst the 10 having two marks were distributed thus:—5 to 10 years, one; 15 to 20, one; 20 to 30, three; 30 to 40, three; 50 to 60, two.

Table LXXXIV.

—	Number of Marks.										Total.	
	Four or More.		Three.		Two.		One.		Not Recorded.			
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	—	—	—	—	—	—	1	—	—	—	1	—
1 to 5 years	1	—	6	—	2	—	2	—	5	—	16	—
5 to 10 „	4	—	9	—	3	1	—	—	11	—	27	1
10 to 15 „	5	—	33	—	15	—	3	—	9	—	65	—
15 to 20 „	8	—	42	—	17	1	1	—	28	1	96	2
20 to 30 „	14	—	77	—	63	3	10	—	46	—	210	3
30 to 40 „	6	1	33	—	45	3	10	—	32	3	126	7
40 to 50 „	1	—	8	—	20	—	2	—	17	1	48	1
50 to 60 „	3	—	2	—	8	2	1	—	8	—	22	2
60 to 70 „	—	—	—	—	1	—	2	—	5	—	8	—
70 and over	—	—	—	—	—	—	1	—	1	—	2	—
Age not ascertained	—	—	—	—	1	—	1	—	4	—	6	—
	42	1	210	—	175	10	34	—	166	5	627	16

Vaccination and small-pox.

It will be seen from Table LXXXIV. that the number of scars mostly varied inversely as the ages of the subjects, the per-centage being:—

Number of Marks.	Under 10 Years.	10 to 30 Years.	30 years and Under.	At all Ages.
	Per cent.	Per cent.	Per cent.	Per cent.
Four or more -	17·8	9·3	7·	9·1
Three - -	53·5	52·7	30·	45·5
Two - - -	17·8	33·	51·7	38·
One - - -	10·7	4·8	11·1	7·3

Foveation of Scars.—A well-defined and characteristic mark of vaccination should be regular in outline, white in colour, and stippled with minute depressions. There is abundant scope for variation in the degree of such foveation, and for the purposes of analysis one may group the cases into series according as all the marks are (*a*) plain and well foveated, (*b*) some foveated, others not, or in which the foveation and outline of the scar are indistinct, (*c*) those marks which present no foveation, but either a smooth surface, and perhaps a faint appearance; or else composed of more or less radiate cicatricial tissue, causing a mark of great prominence and irregular outline. It is sometimes difficult to determine in cases of this group whether the scars have been produced by vaccination or not. When they are thick and irregular, often of large area, they indicate that the vaccination has been accompanied by extensive and perhaps deep ulceration.

Of the 416 cases, of which the records are given, one may place 294 amongst the first group, 32 in the second, and 90 in the third, but it must be remarked that the classification is an arbitrary one, and too much stress cannot be laid on the conclusions drawn from an analysis based upon it.

TABLE LXXXV.

Foveation of Scars.

—	Foveate.		Part (or faint) Foveate.		Smooth and faint Scars.		Not Recorded.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year - - -	—	—	—	—	1	—	—	—	1	—
1 to 5 years - - -	4	—	—	—	6	—	6	—	16	—
5 to 10 „ - - -	12	—	—	—	3	—	12	1	27	1
10 to 15 „ - - -	27	—	8	—	14	—	16	—	65	—
15 to 20 „ - - -	48	1	4	—	11	—	33	1	96	2
20 to 30 „ - - -	118	1	10	—	14	1	68	1	210	3
30 to 40 „ - - -	54	1	7	—	24	1	41	5	126	7
40 to 50 „ - - -	21	—	1	—	9	—	17	1	48	1
50 to 60 „ - - -	8	1	2	—	2	—	10	1	22	2
60 to 70 „ - -	1	—	—	—	4	—	3	—	8	—
70 and over - - -	—	—	—	—	1	—	1	—	2	—
Age not ascertained - -	1	—	—	—	1	—	4	—	6	—
	294	4	32	—	90	2	211	10	627	16

Having foveate marks, 294; 4 died, or 1·3 per cent.
„ partly or faintly foveate marks, 32; none died.
„ smooth, faint or thick scars, 90; 2 died; 2·2 per cent.

And as regards age, the four fatal cases amongst the foveated class occur in each of the four periods, 15 to 20, 20 to 30, 30 to 40, and 50 to 60; whilst the two fatal cases in the "scarred" class occurred amongst the ages 20 to 30, and 30 to 40.

Excluding two of whom the ages were not ascertained, the per-centage proportion of the various qualities of scars at each of those age periods is as follows (*see* Table LXXXV.):—

—	Under 10 Years.	10 to 30 Years.	30 Years and upwards.	All ages.
	Per cent.	Per cent.	Per cent.	Per cent.
Plain foveate - -	61·5	75·9	62·7	70·7
Partly (or faintly) foveate.	—	8·6	7·4	7·7
Smooth, faint or thick sores.	38·5	15·3	29·9	21·5

Area of Scars.—The classification of the vaccination scars according to their areas here adopted is that employed in the statistical tables of the Metropolitan Asylums Board, upon the basis of which Table LXXXIII. has been constructed. The groups are three in number, viz., Class A^1, having marks the total area of which measures one half or more than one square inch; Class A^2, in which the total area of marks is one third or less than one half square inch; and Class A^3, in which the total area is less than one-third square inch.

The area was obtained in 290 cases,* of which 246 fall into Class A^1 (three deaths, mortality 1 per cent.); 27 into Class A^2 (one death, mortality 3·7 per cent.); and 17 into Class A^3 (one death, mortality 5·8 per cent.).

The three fatal cases in Class A^1 fell into periods 30 to 40, two cases; and 50 to 60, one case; the one fatal case in Class A^2 was in period 15 to 20; and the one in Class A^3 was in period 30 to 40 years.

---

* It may be added that this and other details were obtained as regards the vaccination of several of the inmates of the houses visited who did not have small-pox; but the facts so obtained do not seem of sufficient value to be subjected to analysis.

TABLE LXXXVI.

Area of Scars.

—	Class A¹.		Class A².		Class A³.		Class A⁴.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	—	—	—	—	1	—	—	—	1	—
1 to 5 years	5	—	—	—	1	—	10	—	16	—
5 to 10 „	10	—	—	—	—	—	17	1	27	1
10 to 15 „	33	—	7	—	—	—	25	—	65	—
15 to 20 „	40	—	1	1	—	—	55	1	96	2
20 to 30 „	91	—	9	—	4	—	106	3	210	3
30 to 40 „	47	2	5	—	7	1	67	4	126	7
40 to 50 „	13	—	3	—	2	—	30	1	48	1
50 to 60 „	7	1	1	—	—	—	14	1	22	2
60 to 70 „	—	—	1	—	1	—	6	—	8	—
70 and over	—	—	—	—	1	—	1	—	2	—
Age not ascertained	—	—	—	—	—	—	6	—	6	—
	246	3	27	1	17	1	337	11	627	16

In the above Table (LXXXVI.) the figures are assigned under each age-period, and the per-centage proportions may be summarised thus:—

—	Under 10 Years.	10 to 30 Years.	30 Years and over.	At all Ages.
	Per cent.	Per cent.	Per cent.	Per cent.
Class A¹	88·2	88·6	76·1	84·8
Class A²	—	9·1	11·3	9·3
Class A³	11·8	2·1	12·5	5·8

Number, Foveation, and Area combined.—It is, however, on a combination of each of these characters that the most accurate estimate of the character of vaccination may be held to depend; and the figures given in Table LXXXIII. supply the means for such an analysis.

It will be found on reference to this table that of the 480 cases in which one or other of these particulars were noted; in 271 the area, number, and character are given; in 139 the number and character; in 15 the area and number; in 1 the area and character; whilst in 46 the number alone; in 5 the area alone; and in 15 the character alone.

Only two fatal cases occur amongst the 271, of which all details are known; and the largest group, that of Class A¹, having 227 cases, had no fatal case; one death occurred in Class A², at age 15–20, with two foveate marks; the other, in Class A³, at age 30–40, with two "smooth" marks.

The accompanying table (Table LXXXVII.) gives an analysis of these 271 cases, extracted from the larger table already given:—

TABLE LXXXVII.

AREA OF CICATRIX OR CICATRICES.

—	Class A^1.												Class A^2.											
	Number of Scars.												Number of Scars.											
	Four or more.			Three.			Two.			One.			Four or more.			Three.			Two.			One.		
	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.
Under 1 year	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
1 to 5 years	—	—	1	1	—	3	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
5 to 10 „	2	—	—	5	—	2	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10 to 15 „	2	—	—	13	7	4	3	—	2	—	—	—	—	—	—	—	—	1	2	—	2	1	—	1
15 to 20 „	3	1	—	17	2	4	7	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
20 to 30 „	9	—	—	29	5	3	26	4	4	4	—	—	—	—	—	2	—	—	5	—	—	—	—	2
30 to 40 „	2	1	1	5	2	7	15	2	3	5	—	—	—	—	—	—	—	1	3	1	—	—	—	—
40 to 50 „	1	—	—	2	1	—	6	—	3	—	—	—	—	—	—	—	—	—	1	—	1	1	—	—
50 to 60 „	2	—	—	1	—	—	1	2	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—
60 to 70 „	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1
70 and over	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Age not ascertained	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	21	2	2	73	17	23	59	8	13	9	—	—	—	—	—	2	—	2	12	1	3	3	—	4
	25			113			80			9			—			4			16			7		

—	Class A^3.												All Classes.												All Classes.			Total.
	Number of Scars.												Number of Scars.												Foveation of Scars.			
	Four or more.			Three.			Two.			One.			Four or more.			Three			Two.			One.						
	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	
Under 1 year	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	1
1 to 5 years	—	—	—	—	—	—	—	—	—	1	—	—	—	—	1	1	—	3	—	—	—	1	—	—	2	—	4	6
5 to 10 „	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	5	—	2	1	—	—	—	—	—	8	—	2	10
10 to 15 „	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	13	7	5	5	—	4	1	—	1	2	7	10	38
15 to 20 „	—	—	—	—	—	—	—	—	—	—	—	—	3	1	—	17	2	4	8	—	1	—	—	—	28	3	5	36
20 to 30 „	—	—	—	—	—	—	3	—	1	—	—	—	9	—	—	31	5	3	34	4	5	4	—	2	78	9	10	97
30 to 40 „	—	—	—	—	—	1	—	—	3	3	—	—	2	1	1	5	2	9	18	3	6	8	—	—	33	6	16	55
40 to 50 „	—	—	—	—	—	—	—	—	1	1	—	—	1	—	—	2	1	—	7	—	5	2	—	—	12	1	5	18
50 to 60 „	—	—	—	—	—	—	—	—	—	—	—	—	2	—	—	1	—	—	1	2	—	1	—	—	5	2	—	7
60 to 70 „	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	2	—	—	2	2
70 and over	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	1	1
Age not ascertained	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	1	3	—	5	5	—	3	21	2	2	75	17	26	74	9	21	17	—	7	187	28	56	271
	—			1			8			8			25			118			104			24			271			

This table speaks for itself, but it may be useful to give a summary analysis of it:—

At ages *under* 10 *years*, 17 cases:—
Class A^1, 15 cases:—
Having 4 marks 5, viz., foveate 4, smooth 1.
,, 3 ,, 11, ,, ,, 6, ,, 5.
,, 2 ,, 1, ,, ,, 1.
Class A^3, 2 cases:—
Having 1 mark 2, viz., foveate 1, smooth 1.

At ages 10 *to* 30 *years*, 171 cases:—
Class A^1, 150 cases:—
Having 4 marks 15, viz., foveate 14, partly foveate 1.
Having 3 marks 84, viz., foveate 59, partly foveate 14, smooth 11.
Having 2 marks 47, viz., foveate 36, partly foveate 4, smooth 7.
Having 1 mark 4, viz., foveate 4.
Class A^2, 17 cases:—
Having 3 marks 3, viz., foveate 2, smooth 1.
,, 2 ,, 10, ,, ,, 8,* ,, 2.
,, 1 ,, 4, ,, ,, 1, ,, 3.
Class A^3, 4 cases:—
Having 2 marks 4, viz., foveate 3, smooth 1.

At ages 30 *years and upwards*, 83 cases:—
Class A^1, 62 cases:—
Having 4 marks 7, viz., foveate 5, partly foveate 1, smooth 1.
Having 3 marks 18, viz., foveate 8, partly foveate 3, smooth 7.
Having 2 marks 32, viz., foveate 22, partly foveate 4, smooth 6.
Having 1 mark 5, viz., foveate 5.
Class A^2, 10 cases:—
Having 3 marks 1, viz., smooth 1.
Having 2 marks 6, viz., foveate 4, partly foveate 1, smooth 1.
Having 1 mark 3, viz., foveate 2, smooth 1.
Class A^3, 11 cases:—
Having 3 marks 1, viz., smooth 1.
,, 2 ,, 4, ,, ,, 4.*
,, 1 ,, 6, ,, foveate 4, smooth 2.

Vaccination and small-pox.

It will have been noticed that one infant under one year of age, said to have been vaccinated, contracted small-pox. This is the case of M. E. B., æt. eight months (Batley, 69). She had only a single non-foveated mark on the arm, of less than one-third of an inch in area. Her attack is described as a discrete one, but it is not known how she contracted the disease. Her father, W. B., æt. 25, a miner (vaccinated) was also attacked with small-pox about nine weeks afterwards. There were seven other inmates of the house, all of whom were vaccinated, except M. B., æt. 46, a weaver, who had suffered from small-pox when 15 years of age.

Another noteworthy case, as regards the youth of the patient, is that of E. W., an infant 19 months of age (Ba. 225), who presented three foveate vaccination scars (area unrecorded) and who had a severe (confluent) attack of small-pox. Her unvaccinated sister, C. A. W., æt. 8 (Ba. 304), developed a rash 14 days later, and also had a severe attack. I have no details of the other members of this family.

Fatal Cases.—There were 16 deaths amongst the vaccinated subjects, eight males, eight females. One (Batley, 544), a boy seven years of age, an epileptic, was recovering from a discrete attack of the disease when he was seized with epilepsy, which proved fatal. This can hardly be considered a death from small-pox. Another (Dewsbury, 185), a young man, æt. 20, was under treatment at the Workhouse Infirmary for erysipelas when attacked with small-pox. A man (Dewsbury, 257), of robust appearance, had a severe attack of small-pox, and died rather suddenly from cardiac failure on the 16th day of the disease. A female, æt. 33 (Liversedge, 18), became comatose before the rash was fully out, uræmia? Another woman (Batley, 6), æt. 20, was in the third month of pregnancy. One (Dewsbury, 62), a schoolmistress, æt. 34, had not been in good health for some months. But of the rest there is no evidence that their health was in any way enfeebled before the attack of small-pox. A list of these cases is subjoined, together with the particulars as to their vaccination. Three fall into the Class A^1, one into Class A^2, one into Class A^3, and 11 into Class A^4, *i.e.*, the group in which the area of vaccination marks is not recorded.

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* One fatal.

Table LXXXVIII.

Fatal Cases of Small-Pox in Vaccinated Subjects.

Reference.	Name.	Sex.	Age.	Type.	Vaccination.			Remarks.
					No.	Character.	Area.	
Batley, 6 -	J. A.	F.	20	Confluent -	2	Foveate -	A^4	Three months pregnant.
,, 174 -	M. L.	M.	36	,, -	2	?	A^1	Details furnished by Dr. Stewart.
,, 208 -	S. A. R.	F.	17	,,	?	?	A^4	No information obtainable.
,, 391 -	A. A.	F.	19	,, -	2	Foveate -	A^2	
,, 420 -	F. S.	M.	52	,, -	2	?	A^1	"Very large marks." Dr. Stewart.
,, 427 -	G. T.	F.	32	,, -	2	Smooth -	A^3	Details by Dr. Stewart.
,, 441 -	W. H. B.	M.	56	,, -	2	Foveate -	A^4	Ditto.
,, 542	P. H.	M.	38	,, -	?	?	A^4	Said to have been "twice" vaccinated.
,, 544 -	N. H.	M.	7	Discrete -	?	?	A^4	An epileptic; died from attack of epilipsy following small-pox.
Dewsbury, 62 -	H. G.	F.	34	Confluent -	?	?	A^4	"Out of health" at time of attack.
,, 185 -	F. J.	M.	20	,, -	?	?	A^4	Workhouse inmate. Convalescing from erysipelas when attacked.
,, 195 -	S. S.	M.	36	,, -	?	?	A^1	Previous health good.
,, 201	J. A. K.	F.	35	,, -	4	Foveate -	A^4	Fair health previously.
,, 257 -	O. C.	M.	44	,, -	?	?	A^4	Syncope (? morbus cordis).
Liversedge, 18	E. H.	F.	33	Undetermined	?	?	A^4	Died comatose on 5th day (2nd day of rash).
Thornhill, 4 -	H. B.	F.	22	Confluent -	2	Smooth -	A^4	Treated by Mr. H. "hydropathically."

Re-vaccination.—There were 14 individuals attacked with small-pox who were either directly known to have been re-vaccinated, or reported to have undergone it. They are mentioned in the annexed Table (LXXXIX.). I have not included in the list the case of H. G., æt. 34, already given in Table LXXXVIII.; for although it appears that she had been vaccinated in infancy, this vaccination "did not take" (brother's statement), and she was not really vaccinated until she was 17 years of age. The only evidence of re-vaccination in another fatal case

Vaccination and small-pox.

(Ba. 542) is the statement that the man had served in the army; but according to his mother he only presented "one small mark on the arm," and "one on the leg," the latter where he had been vaccinated in his youth in Ireland.

The remaining cases were either mild or discrete in type, with the exception of one alleged to have been re-vaccinated 15 years ago, when attack was a confluent one (D. 193.)

TABLE LXXXIX.

SMALL-POX IN RE-VACCINATED SUBJECTS.

Reference.	Name.	Sex.	Age.	Type of Attack.	Primary Scars.			Re-vaccination.		Remarks.
					No.	Character.	Area.	Date.	Result.	
Ba. 30 -	C. B.	F.	29	Mild - -	3	Foveate -	A¹	12 days before attack.	3 marks.	Re-vaccinated on occurrence of first case in house.
204 ·	E. H.	M.	53	„ - -	4	„ -	A¹	Last time 27 years ago.	?	In navy—twice done.
237 ·	W.A.H.	M.	21	Discrete -	3	"Good"	A⁴	11 days before	"slight."	No other case in house.
301 -	J. B.	M.	34	Mild - -	?	?	A⁴	About 3 weeks before.	3 marks.	
379 -	J. N.	M.	33	„ - -	?	?	A⁴	?	No evidence	Had been in army.
542 -	P. H.	M.	38	Confluent -	2	?	A⁴	?	"1 mark."	Had been in army; a fatal case.
551 -	E. H.	M.	32	Discrete -	2	Foveate -	A¹	1 day after rash.	"Took."	Concurrent with small-pox.
552 -	M. H.	F.	15	Mild - -	?	?	A⁴	2 days before rash.	Nil.	Children of No. 551.
553 -	K. H.	F.	12	„ - -	?	?	A⁴	3 days before rash.	Nil.	
D. 104 -	E. R.	M.	22	Discrete -	4	Foveate -	A¹	1889 - -	1 mark.	
112 -	M. S.	F.	29	Mild - -	3	„ -	A¹	1888 - -	Nil.	Infirmary nurse.
193 -	J. B.	M.	34	Confluent -	?	?	A⁴	15 years ago -	?	
H. 33 -	J. K.	M.	42	Discrete -	?	?	A⁴	15 days before	Nil.	
Mo. 10 -	S. H.	F.	31	„ -	2	Foveate -	A¹	8 days before	2 vesicles.	Inoculated small-pox (v. p. 90).

The table furnishes, so far as possible, the information of the character of these re-vaccinations. I regret that it is so meagre; but in many of the cases it was not possible to obtain actual inspection. With the greatest latitude it may be said that 10 of these individuals had at one time or another been successfully re-vaccinated, and these may be distributed in three classes :—

(*a.*) Re-vaccinated (in two cases twice) some years prior to the attack of small-pox, five persons; in Batley, Nos. 204 (twice, last time 27 years ago), 379, 542; Dewsbury Nos. 104 (two years), 193 (15 years).

(*b.*) Re-vaccinated shortly before exposure to small-pox infection, one, in Batley No. 301 (about three weeks).

(*c.*) Re-vaccinated during the period of exposure to small-pox infection, four persons. Of these one was infected away from home (B.A. No. 237) and his was the only case of small-pox in his own family. There remain three persons, in Batley Nos. 30, 551; Morley, No. 10, who were apparently infected from other members of the household.

In the analytical tables of infected households given on various pages of this Report, a distinction has been drawn between (1) those re-vaccinated *before* the house was infected by small-pox, and (2) those re-vaccinated *after* the house was infected. As regards the question of immunity, the former class, which contains seven who were attacked with small-pox, ought only to be considered; but strictly speaking, the case (B. A. 237) just referred to, obviously re-vaccinated when incubating the disease, must be excluded, although his household was not infected at the time of his re-vaccination. This case is therefore transferred to the second class, leaving six in the first.

There remain in this table, four persons who had undergone re-vaccination without success, three of them being at the time sickening with small-pox. In addition to these may be mentioned two instances of re-vaccination following an attack of small-pox. W. H. R. (Ba. 309), male, 50, with two primary marks (formation and area not recorded), had a discrete attack. Two months later he was re-vaccinated without success. A. B. (Mo. 23) female, 18, who had just passed through an unrecognised attack of small-pox, was re-vaccinated together with other members of her family on the occasion of two of the rest being attacked; the attempt was unsuccessful.

CLASS II.—NO INFORMATION AS TO VACCINATION.

In this class there occur 10 cases, none of them fatal; viz., 6 males, 4 females.

The ages of the males were:—between 1 and 5 years, one case; one between 5 and 10; 15 and 20 years, one case; 40 and 50 years, three cases.

The females fall:—one between 1 and 5 years; one between 5 and 10 years; two between 20 and 30.

TABLE XC.

—	Males.		Females.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 - -	—	—	—	—	—	—
1–5 - - -	1	—	1	—	2	—
5–10 - - -	1	—	1	—	2	—
10–15 - - -	—	—	—	—	—	—
15–20 - - -	1	—	—	—	1	—
20–30 - - -	—	—	2	—	2	—
30–40 - - -	—	—	—	—	—	—
40–50 - - -	3	—	—	—	3	—
	6	—	4	—	10	—

Vaccination and small-pox.

CLASS III.—ALLEGED VACCINATION.

In this class there were 25 cases, 6 males and 19 females, the latter supplying the two fatal cases.

TABLE XCI.

—	Male.		Female.		Total.		Proportion to whole Number in Age Periods.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
							Per cent.	Per cent.
Under 1 year	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	—	—
1 to 5 years	—	—	—	—	—	—	—	—
5 to 10 „	—	—	1	—	1	—	—	—
	—	—	—	—	1	—	4·0	—
10 to 15 years	2	—	2	—	4	—	—	—
15 to 20 „	2	—	4	—	6	—	—	—
20 to 30 „	2	—	5	1	7	1	—	—
	—	—	—	—	17	1	68·0	50·0
30 to 40 years	—	—	3	—	3	—	—	—
40 to 50 „	—	—	1	1	1	1	—	—
50 to 60 „	—	—	2	—	2	—	—	—
60 to 70 „	—	—	—	—	—	—	—	—
70 years and over	—	—	1	—	1	—	—	—
	—	—	—	—	7	1	28·0	50·0
	6	—	19	2	25	2	—	—

The only comment necessary to make respecting this class is that it might have embraced a larger number had it been possible to have obtained inspection of every patient. It may be remembered that there were 147 in the vaccinated class of whom there is no record as to the area, character, or number of marks. Some of these might, on inspection, have been found to present "no evidence of vaccination."

CLASS IV.—"UNDER" VACCINATION.

In this class there were 21 cases, 10 males, one fatal; 11 females, two fatal. All were under 30 years of age.

TABLE XCII.

—	Male.		Female.		Total.		Proportion of whole Number in Age Period.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
							Per cent.	Per cent.
Under 1 year	4	1	3	2	7	3	—	—
	—	—	—	—	7	3	33·3	100·
1 to 5 years	3	—	3	—	6	—	—	—
5 to 10 „	1	—	3	—	4	—	—	—
	4	—	6	—	10	—	47·6	—
10 to 15 years	2	—	—	—	2	—	—	—
15 to 20 „	—	—	1	—	1	—	—	—
20 to 30 „	—	—	1	—	1	—	—	—
	—	—	—	—	4	—	19·0	—
	10	1	11	2	21	3	—	—

The subjoined list includes all those who fall into this class. In every case the subject was a member of a family in which, on the appearance of a case of small-pox, those not previously vaccinated were vaccinated for the first time; and in nearly every case this vaccination, running concurrently with the small-pox, was successful.

In one vaccination was performed on the second day of illness.

In one vaccination was performed one day before illness.

In three vaccination was performed two days before illness.

In three vaccination was performed three days before illness.

In one vaccination was performed four days before illness.

In one vaccination was performed five days before illness.

In four vaccination was performed seven days before illness.

In three vaccination was performed eight days before illness.

In three vaccination was performed 13 days before illness.

In one vaccination was performed 14 days before illness.

Vaccination and small-pox.

TABLE XCIII.

TABLE of CASES of SMALL-POX attacked whilst undergoing PRIMARY VACCINATION.

—	Ref. in Reg.	Name.	Sex.	Age.	Onset of Illness.	Date of Rash.	Date of Vaccination.	Result of Vaccination.	Day of Vaccination when attacked.	Type of Attack.	Result.	—
1	Batley, 102 -	J. McQ.	M.	12	4/1/92	4/1/92	28/12/91	S.	8th	Discrete -	R.	S.=Result of vaccination successful.
2	„ 103 -	M. McQ.	F.	18	2/1/92	3/1/92	1/1/92	S.	2nd	Confluent	R.	
3	„ 104 -	H. McQ.	M.	3mo.	4/1/92	4/1/92	28/12/91	S.	8th	Confluent	R.	
4	„ 143 -	H. H.	M.	14	9/1/92	10/1/92	6/1/92	S.	4th	Coherent -	R.	
5	„ 177 -	S. A. S.	F.	20	16/1/92	19/1/92	9/1/92	S.	8th	Mild -	R.	
6	„ 334 -	B. G.	F.	11mo.	14/2/92	16/2/92	12/1/92	S.	3rd	Confluent	D.	
7	„ 520 -	H. B.	M.	6	5/2/92	8/2/92	22/1/92	S.	15th	Mild -	R.	
8	„ 546 -	A. H.	F.	10mo.	?	16/6/92	8/6/92	S.	?	Coherent -	R.	
9	Dewsbury, 82 -	H. W.	F.	5	18/2/92	21/2/92	16/2/92	S.	3rd	Confluent	R.	
10	„ 83 -	W. W.	M.	3	18/2/92	21/2/92	16/2/92	S.	3rd	Coherent -	R.	
11	„ 145 -	H. R.	M.	4mo.	12/4/92	13/4/92	9/4/92	S.	4th	Mild -	R.	
12	„ 176 -	E. B.	F.	4	30/4/92	5/5/92	23/4/92	S.	8th	Type? -	R.	
13	„ 264 -	E. M. P.	F.	12dys.	2/6/92	6/6/92	27/5/92	S.	6th	Confluent	D.	Born when mother attacked with small-pox.
14	Birstal, 8 -	H. D.	M.	9dys.	29/3/92	29/3/92	26/3/92	S.	4th	Confluent	D.	Born when mother attacked with small-pox.
15	Liversedge, 20 -	J. E. H.	M.	7mo.	4/7/92	7/7/92	2/7/92	S.	3rd	Mild -	R.	
16	Morley, 2 -	L. D.	F.	7	25/1/92	27/1/92	29/1/92	S.	—	Confluent	R.	
17	„ 9 -	M. E. H.	F.	2	27/4/92	28/4/92	15/4/92	S.	14th	Confluent	R.	
18	„ 22 -	W. H.	M.	1	3/7/92	3/7/92	25/6/92	S.	9th	Mild -	R.	
19	„ 37 -	A. C.	F.	3	20/7/92	20/7/92	12/7/92	S.	9th	Mild -	R.	
20	„ 39 -	J. K.	M.	2	20/8/92	20/8/92	7/8/92	S.	14th	Mild -	R.	
21	„ 40 -	E. K.	F.	5	20/8/92	20/8/92	7/8/92	S.	14th	Mild -	R.	

ANALYSIS OF TABLE XCIII.

CONCURRENT VACCINIA and VARIOLA.

VACCINATED.

—	Days before Appearance of Rash.										Days after Rash.	
	17	13	12	10	8	7	5	4	3	2	2	—
Under 1 year -				Cf.	Cf.	Cf.	M.	Cf. M.	Cf.			Confluent 5 (3 d.) Mild 2.
1 to 5 years -		M. Cf.	?		M. M.		Cf.					Confluent 2. Mild 3. Type? 1.
5 „ 10 „ -	M.	M.					Cf.				Cf.	Confluent 2. Mild 2.
10 „ 15 „ -						D.		Ch.				Discrete 1. Coherent 1.
15 „ 20 „ -										Cf.		Confluent 1.
20 „ 30 „ -				M.								Mild 1.
	1	3	1	2	3	2	3	3	1	1	1	21

It will be seen that the vaccination in these cases did not invariably have much, if any, modifying influence. In the seven children under one year of age three attacks were fatal, but two of these were newly-born infants, whose mothers were suffering from small-pox at the time of the births. These infants were vaccinated as soon as possible, one 10 days, and the other four days before the rash of small-pox appeared. The other fatal case was a child of 11 months, who was vaccinated only three days before the rash made its appearance. However, even in this series there were two infants aged four months respectively who had mild attacks, and who had been vaccinated, the one four days, the other five days before the rash appeared.

Of the five children between one and five years, two, vaccinated 13 and five days before the rash respectively, had severe attacks, and three had mild attacks, vaccinated 13 and eight days before the rash, but these all occurred at Morley where the prevalent type of small-pox at the time was singularly mild, and mostly affected children. [*See* Part III., Morley, *p.* 91.]

Of the four children between five and 10 years, mild attacks were seen in two, vaccinated one 17 days before the rash, the other 13 days (a Morley case). Severe attacks were experienced by two others, the one vaccinated four days before the rash, the other not until its admission into hospital two days after the rash had appeared. Nevertheless, in this case, four large vesicles formed at the vaccination sites.

Of those above 10 years of age, four in number, one only had a mild attack. This was the case of S. A. S., 20 years of age, who was successfully vaccinated during the incubation of small-pox, 10 days before the rash appeared.

CLASS V.—UNVACCINATED.

There were 346 unvaccinated persons amongst the total of 1,029 cases of small-pox—a proportion of 33·6 per cent. —just about one-third. Of this number, 180 were males, 49 being fatal cases; 166 were females, 40 being fatal cases.

Vaccination and small-pox.

Table XCIV.

—	Males.		Females.		Total.		Proportion of whole number in Age Periods.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	10	6	11	10	21	16	Per cent. —	Per cent. —
	—	—	—	—	21	16	6·3	18·0
1 to 5 years	26	11	32	11	58	22	—	—
5 to 10 ,,	36	8	42	7	78	15	—	—
	—	—	—	—	136	37	39·3	41·5
10 to 15 years	22	2	17	1	39	3	—	—
15 to 20 ,,	40	4	35	3	75	7	—	—
20 to 30 ,,	30	11	22	6	52	17	—	—
	—	—	—	—	166	27	48·0	30·3
30 to 40 years	8	2	3	1	11	3	—	—
40 to 50 ,,	5	5	2	—	7	5	—	—
50 to 60 ,,	1	—	1	1	2	1	—	—
60 to 70 ,,	—	—	1	—	1	—	—	—
70 years and over	1	—	—	—	1	—	—	—
	—	—	—	—	22	9	6·3	10·1
Age not ascertained	1	—	—	—	1	—	—	—
	180	49	166	40	346	89	—	—

Contrasting the two sexes in this class as to mortality at various age periods, it is seen that :—

Of the whole number, *males,* mortality, 27·2 per cent., *females,* 24·1 per cent.
At under 1 year ,, ,, 60·0 ,, ,, 90·9 ,,
1 to 10 years ,, ,, 30·6 ,, ,, 24·0 ,,
10 to 30 years ,, ,, 18·4 ,, ,, 13·7 ,,
30 years and over ,, ,, 46·6 ,, ,, 28·5 ,,

I append here a list of small-pox amongst infants. It may be re-called that there were in all 29 attacks under 1 year of age ; one of these infants was vaccinated, and seven were undergoing primary vaccination.

Table XCV.

Small-Pox in Unvaccinated Infants.

—	Reference to Register.	Name.	Sex.	Age.	Onset.	Rash.	Type.	Date of Death.	Duration of Illness.	——
1	Batley, 3 -	T. C.	M.	5 mos.	May 11 - -	May 14 - -	Confluent.	May 14	5 days.	
2	,, 14 -	E. P.	F.	2 ,,	June 30 - -	July 3 - -	,,	July 8 -	9 ,,	
3	,, 27 -	S. E. B.	F.	7 ,,	Nov. 21 - -	Nov. 24 - -	,,	Nov. 29	9 ,,	
4	,, 28 -	C. T.	F.	3 ,,	Nov. 16 - -	?	,,	Dec. 1 -	15 ,,	
5	,, 134 -	E. B.	F.	7 days	Jan. 7 - -	Jan. 10 - -	,,	Jan. 11	5 ,,	
6	,, 149 -	C. H.	M.	6 mos.	Jan. 12 - -	Jan. 12 - -	,,	Jan. 21	10 ,,	
7	,, 201 -	A. F.	F.	10 ,,	Jan. 18 - -	Jan. 23 - -	,,	—	—	Recovered.
8	,, 230 -	H. B.	F.	3 weeks	Jan. 21 - -	?	,,	Feb. 7 -	18 ,,	
9	,, 267 -	F. W.	M.	5 mos.	Feb. 1 - -	Feb. 2 - -	,,	Feb. 11	11 ,,	
10	,, 332 -	T. L.	M.	2 weeks	Feb. 16 - -	Feb. 18 - -	,,	Feb. 22	7 ,,	
11	,, 374 -	W. McN.	M.	5 mos.	Feb. 23 - -	Feb. 26 - -	Discrete.	—	—	Recovered.
12	,, 478 -	J. I.	F.	9 weeks	April 2 - -	April 5 - -	Confluent.	April 8	7 ,,	
13	,, 501 -	E. W.	F.	3 ,,	April 21 - -	April 23 - -	,,	April 29	9 ,,	
14	,, 524 -	L. C.	F.	2 ,,	April 6 - -	?	,,	April 14	9 ,,	
15	,, 527 -	B. P.	M.	7 mos.	April 29 - -	May 1 - -	Discrete.	—	—	Recovered.
16	Dewsbury, 23 -	L. D.	F.	11 ,,	Oct. 15 - -	Oct. 17 - -	Confluent.	Oct. 23 -	9 ,,	
17	,, 76 -	R. M.	M.	5 ,,	Feb. 16 - -	Feb. 20 - -	,,	Feb. 25	10 ,,	
18	,, 190 -	C. A. S.	F.	8 ,,	April 28 - -	May 2 - -	,,	May 9 -	12 ,,	
19	,, 260 -	C. R.	M.	4 ,,	July 26 - -	July 29 - -	Coherent.	—	—	Recovered.
20	Morley, 19 -	J. E. B.	M.	7 ,,	June 18 - -	June 21 - -	Mild.	—	—	
21	Soothill Upper, 23	F. S.	M.	12 days	Feb. 22 - -	?	Type uncertain.	Feb. 26	5 ,,	

Vaccination and small-pox.

Thus there were six infants attacked under 4 weeks of age (two males, four females), all of whom died; two were between the ages of 1 and 3 months (two females) both of whom died; six were between 3 and 6 months (five males, one female)—two recovered (both males), four died; five between 6 and 9 months (three males, two females)—two recovered (both males), and three died (one male, two females); and two between 9 and 12 months (both females), of whom one died.*

In concluding this survey of the vaccination relations of those attacked with small-pox, it is instructive to contrast the two main classes, viz., those known to have been vaccinated and those known not to have been vaccinated, as regards the age incidence and proportion of fatal cases at each period:—

Thus of the *vaccinated*—

1·5 per cent. were under 1 year of age, yielding no fatal case.
6·8 per cent. were 1 to 10 years of age, yielding 6·2 per cent. of the total fatal cases.
59·1 „ were 10 to 30 years of age, yielding 21·2 per cent. of the total fatal cases.
32·8 „ were 30 years upwards, yielding 62·5 per cent. of the total fatal cases.

Of the *unvaccinated*—

6·0 per cent. were under 1 year of age, yielding 18·0 per cent. of the total fatal cases.
39·3 „ were 1 to 10 years of age, yielding 41·5 per cent. of the total fatal cases.
48·0 „ were 10 to 30 years of age, yielding 30·3 per cent. of the total fatal cases.
6·0 „ were 30 years upwards, yielding 10·1 per cent. of the total fatal cases.

Taking each age period, and calculating the proportion of cases and of the deaths in each group, we have:—

—	Vaccinated.		No information on Vaccination.		Alleged Vaccination.		Under Vaccination.		Unvaccinated.		Mortality on whole Number.
	Proportion of Cases.	Deaths.	Proportion of Cases.	Deaths.	Proportion of Cases.	Deaths.	Proportion of Cases.	Deaths.	Proportion of Cases.	Deaths.	
	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.	Per cent.
Under 1 year - - -	3·4	—	—	—	—	—	24·1	15·8	72·4	84·2	65·5
1 to 10 years - - -	22·	2·6	2·	—	0·5	—	5·1	—	70·1	97·4	34·5
10 to 30 years - - -	66·2	15·1	0·5	—	3·	3·	0·7	—	29·5	81·8	30·
30 years and over - -	86·5	50·	1·2	—	3·	5·	—	—	9·2	45·	18·

---

* The statutory age for vaccination being 3 months, and the fact that (*vide supra*) only one out of 22 infants under 1 year of age (*i.e.*, excluding seven who were "under" vaccination when attacked) attacked with small-pox was vaccinated, suggests the inference that the number of cases in this age period if all had been duly vaccinated (at 3 months) might have been reduced to about 10 (or less than one-half) and the deaths to 8. This would not have reduced the proportionate mortality—since all those under 3 months died—but would have raised it from 72·7 per cent. (*i.e.*, 16 deaths out of 22 attacks) to 80 per cent. (*i.e.*, 8 deaths out of 10 attacks), but the gross mortality like the total number attacked would have been reduced one-half.

Explanation of Chart XVII.

Vaccination Data of 3,000 *Persons exposed to Small-pox Infection.*

This chart is designed to show the incidence of small-pox upon the inmates of 544 houses invaded by the disease in the Dewsbury Union; and at the same time to indicate the relative numbers of those attacked in each "vaccination-class."

Each small square in the diagram represents one person, those left unshaded represent those of the inmates who were exposed to infection, but not attacked, the shaded squares indicate those who were attacked.

Fatal cases of small-pox are indicated by the sign +; and a previous attack of small-pox by the sign ⊙.

The diagram therefore shows that:—
3,000 persons exposed to infection, 887 contracted the disease, of whom 83 died, and 6 previously had small-pox.

Of the 2,113 individuals exposed, but not infected, 120 had previously had small-pox.

Of the whole 3,000:—
2,271 were vaccinated, of whom 544 were attacked.

In 44 vaccination was alleged, but no evidence was visible; of these 24 were attacked.

78 were "undergoing" vaccination when exposed, and 21 were undergoing vaccination when attacked.

In 80 no information on the point was available; of these 4 were attacked.

527 were unvaccinated, of whom 294 were attacked.

—	*All Inmates.*		*Attacked with Small-pox.*		
	—	*Previous Small-pox.*	—	*Fatal.*	*Previous Attack.*
Vaccinated - -	2,271	66	544	11	(2)
Alleged Vaccination.	44	2	24	2	—
"Under" Vaccination	78	—	21	3	—
"No information"	80	8	4	—	(1)
Unvaccinated -	527	50	294	67	(3)

Explanation of Chart XVIII.

In this chart the data given in the preceding chart (XVII.) have been divided among three age groups, viz.:—Age 0 to 10, 10 years to 30, 30 years and upwards, and those whose age was not ascertained.

Group A. (ages 0 to 10) contains 729 individuals, of whom 203 were attacked with small-pox.

Group B. (ages 10 to 30) contains 1,349 individuals, of whom 482 were attacked with small-pox.

Group C. (ages 30 years and upward) contains 901 individuals, of whom 202 were attacked with small-pox.

Group D. (age not ascertained) contains 21 individuals, of whom none were attacked with small-pox.

In A. 405 were vaccinated, of whom 41 were attacked with small-pox, and one died.

In B. 1,081 were vaccinated, of whom 324 were attacked with small-pox, and four died.

In C. 774 were vaccinated, of whom 179 were attacked with small-pox, and six died.

In D. 11 were vaccinated.

In A. 4 were "alleged" to have been vaccinated, of whom one was attacked.

In B. 19 were "alleged" to have been vaccinated, of whom 16 were attacked, and one died.

In C. 21 were "alleged" to have been vaccinated, of whom seven were attacked and one died.

In A. 57 were "under" vaccination, of whom 17 were attacked, and three died.

In B. 19 were "under" vaccination, of whom four were attacked.

In C. 2 were "under" vaccination, of whom none were attacked.

In A. 7, "no information as to vaccination"; two attacked.

In B. 25, "no information as to vaccination"; one attacked.

In C. 38, "no information as to vaccination"; one attacked.

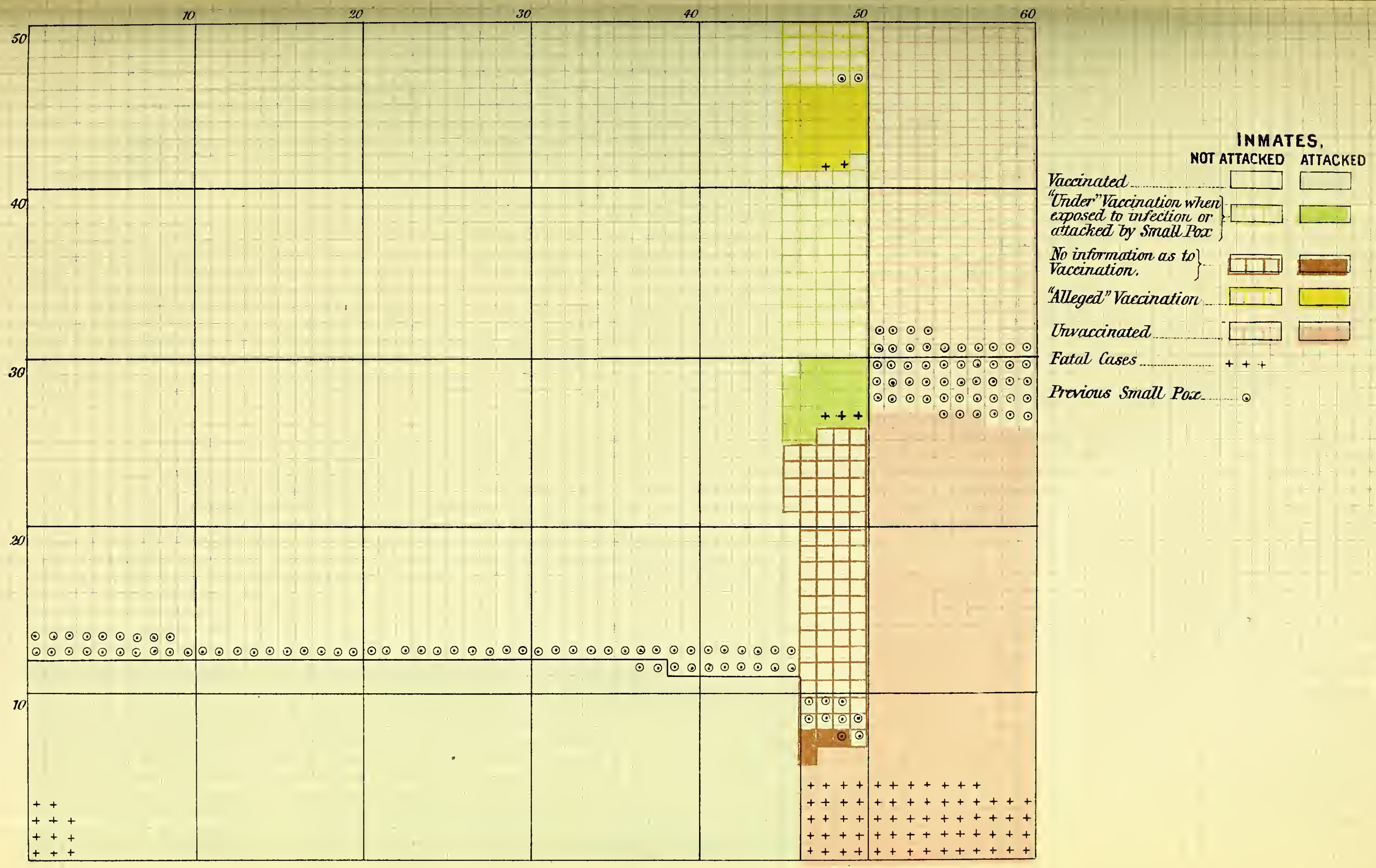
In D. 10, "no information as to vaccination"; none attacked.

In A. 256 were unvaccinated, of whom 142 were attacked and 44 died.

In B. 205 were unvaccinated, of whom 137 were attacked and 19 died.

In C. 66 were unvaccinated, of whom 15 were attacked and four died.

The chart also shows that a previous attack of small-pox had occurred in 21 of those exposed and three of those attacked on this occasion in Group B.; and in 98 of the former and three of the latter in Group C. The distribution of these according to the vaccination of the subjects is shown in the chart.



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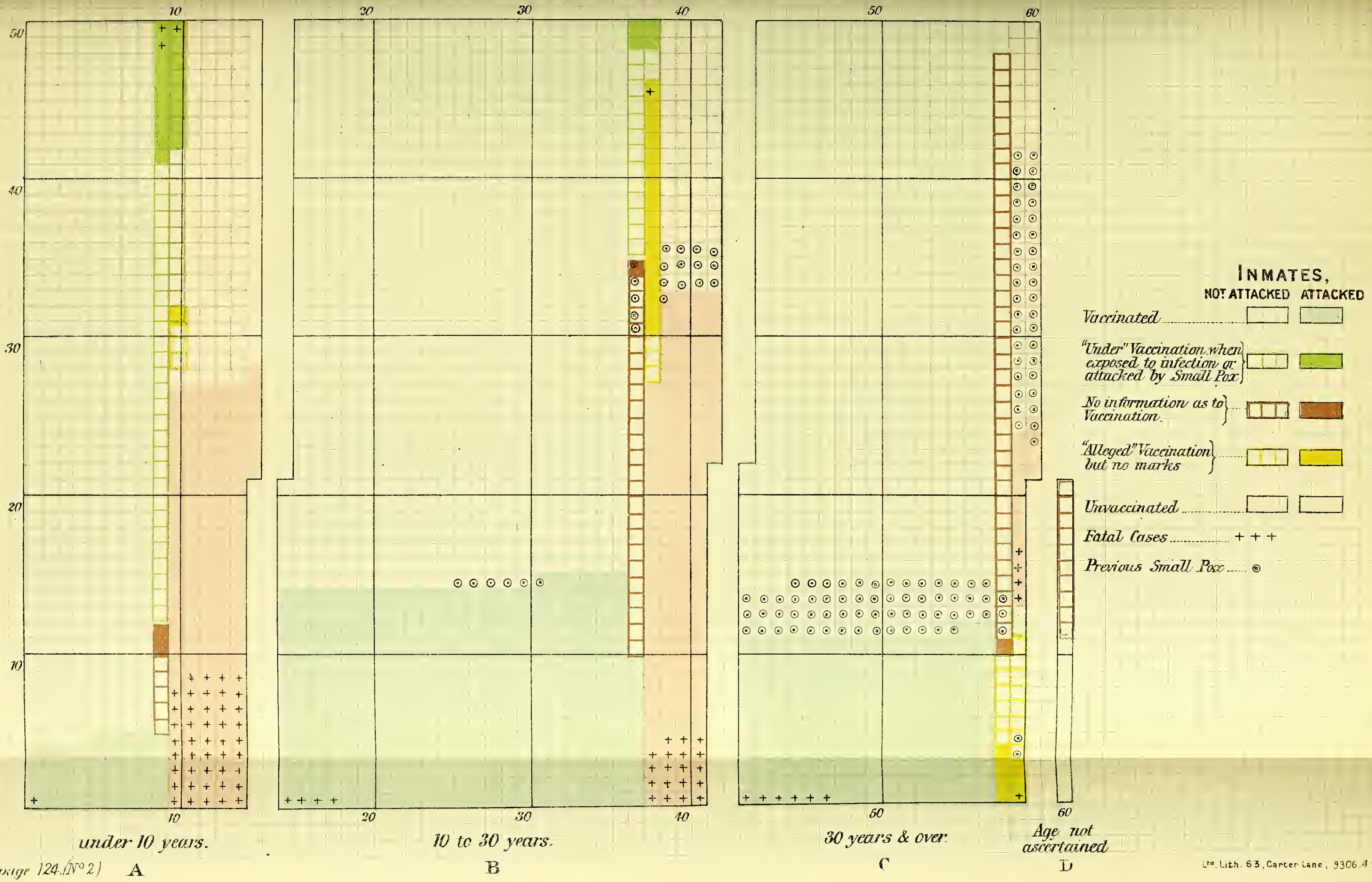

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Comparison of those attacked, and those not attacked with Small-pox dwelling in invaded houses.

The vaccination condition of the 3,000 inmates of the 544 houses visited may be summarised as follows :—

At all ages there were :—
Vaccinated 2,271, or 75·7 per cent.
Alleged to be vaccinated, but having no marks :—44 or 1·5 per cent.
"Under" vaccination, 78, or 2·5 per cent.
Unvaccinated, 527, or 17·5 per cent.

and in 80, no information on the point was available.

Similarly of the 887 cases of small-pox in these households there were :—

Vaccinated - -	544, or 62·4 per cent.
Alleged vaccination -	24 „ 2·7 „
"Under" vaccination -	21 „ 2·3 „
Unvaccinated - -	294 „ 33·1 „
No information - -	4.

And whereas of the whole number the per-centage of the attacked was 29·5,

Of the vaccinated -	it was 24 per cent.
„ "alleged vaccinated"	„ 53·3 „
„ "under-vaccination"	„ 37·2 „
„ unvaccinated -	„ 55·7 „

TABLE XCVI.

INVADED HOUSEHOLDS.—Condition of Vaccination of all Inmates at various Ages.

—	I. Vaccinated.	II. No information.	III. Alleged Vaccination.	IV. "Under" Vaccination.	V. Unvaccinated.	Total.
Under 1 year -	16	—	—	16	43	75
1 to 5 years -	149	3	3	26	106	287
5 „ 10 „ -	239	4	1	15	105	364
10 „ 15 „ -	309	4	4	7	57	381
15 „ 20 „ -	317	7	6	9	86	425
20 „ 30 „ -	456	14	9	3	63	545
30 „ 40 „ -	317	6	6	2	20	351
40 „ 50 „ -	249	15	6	—	27	297
50 „ 60 „ -	137	10	6	—	14	167
60 „ 70 „ -	57	4	2	—	5	68
70 and over -	14	3	1	—	1	19
Age not ascertained	11	10	—	—	—	21
	2,271	80	44	78	527	3,000

TABLE XCVII.

INVADED HOUSEHOLDS.—Condition of Vaccination of those attacked with Small-pox at various Ages.

—	I. Vaccinated.	II. No information.	III. Alleged Vaccination.	IV. "Under" Vaccination.	V. Unvaccinated.	Total.
Under 1 year -	1	—	—	7	17	25
1 to 5 years -	14	2	—	6	55	77
5 „ 10 „ -	26	—	1	4	69	100
10 „ 15 „ -	61	—	4	2	31	98
15 „ 20 „ -	88	1	5	1	66	161
20 „ 30 „ -	175	—	7	1	41	224
30 „ 40 „ -	112	—	3	—	8	123
40 „ 50 „ -	40	1	1	—	4	46
50 „ 60 „ -	17	—	2	—	2	21
60 „ 70 „ -	8	—	—	—	1	9
70 and over -	2	—	1	—	—	3
Age not ascertained	—	—	—	—	—	—
	544	4	24	21	294	887

Vaccination and small-pox.

The proportion of cases of small-pox to the number of inmates of the invaded households, with refcrence to their vaccination condition, may be stated in different age-periods as follows :—

I.—*Vaccinated.*

—	Inmates.	Cases.	Proportion of attacked.
Under 1 year - -	16	1	1 : 16, or 6·2 per cent.
1 to 10 years - -	388	40	1 : 9·7 „ 10·3 „
10 „ 30 „ - -	1,082	324	1 : 3·3 „ 30· „
30 years and upwards -	774	179	1 : 4·3 „ 23· „
Age not ascertained -	11	–	——
	2,271	544	1 : 4

II.—*No information on Vaccination.*

—	Inmates.	Cases.	Proportion of attacked.
Under 1 year - - - -	—	—	—
1 to 10 years - - - -	7	2	1 : 3·5
10 „ 30 „ - - - -	25	1	1 : 25·
30 years and upwards - - -	38	1	1 : 28·
Age not ascertained - - -	10	—	—
	80	4	1 : 20·

III.—*Alleged Vaccination.*

—	Inmates.	Cases.	Proportion of Cases to Inmates.
Under 1 year - -	—	—	——
1 to 10 years - -	4	1	1 : 4, or 25 per cent.
19 „ 30 „ - -	19	16	1 : 1·2 „ 80· „
years and upwards -	21	7	1 : 3· „ 33·3 „
	44	24	1 : 18

IV.—"*Under*" *Vaccination.*

—	Inmates.	Cases.	Proportion of Cases to Inmates.
Under 1 year - -	16	7	1 : 2, or 50· per cent.
1 to 10 years - -	41	10	1 : 4·2 „ 23·8 „
10 „ 30 „ - -	19	4	1 : 4·8 „ 21· „
30 years and upwards -	2	—	——
	78	21	1 : 3·6

V.—*Unvaccinated.*

—	Inmates.	Cases.	Proportion of Cases to Inmates.
Under 1 year - -	43	17	1 : 2·6, or 37·7 per cent
1 to 10 years - -	211	124	1 : 1·7 „ 59· „
10 „ 30 „ - -	206	138	1 : 1·5 „ 63·4 „
30 years and upwards -	67	15	1 : 4·5 „ 22 „
	527	294	1 : 1·8

Vaccination and small-pox.

Influence of Vaccination on the Incidence of Small-pox in Households.

The question of the extent of the "protection" from small-pox afforded by vaccination has already been considered from the point of view of those attacked with the disease, and it remains to attempt the comparison between this class and that of those equally exposed to infection who were not attacked. The phrase "equally exposed" is, however, scarcely accurate, for it is obvious that in every community some members must incur more risks of contagion than others. Those in direct personal attendance upon the sick are, of course, more likely to be infected than those who are seldom, if ever, in contact with them; and in the case of families those whose duties keep them confined to the house where the patient is lying, are more likely to receive infection than those whose avocations take them for many hours daily away from home. On the other hand, the disease may be contracted by the latter class in the school or place of work by contact with sufferers, or with persons coming direct from infected houses. The relative incidence of the disease upon these various classes has been discussed in previous sections of the report, and I do not propose to refer to it again. But for my present purpose it may suffice to note the incidence of small-pox upon the members of households among whom one or more cases of small-pox occurred; in the first place without reference to the differences in liability to exposure to infection, and subsequently with reference to the occurrence of single and of multiple cases in a household, and to the fact whether the cases were removed to hospital for isolation or were kept at home during their attack.

In Part II. it has been stated that particulars were obtained of 544 households, amounting in all to 3,000 individuals, of whom 887 were attacked with small-pox, viz.:—

Batley -	- 267 houses,	465 attacked,	991 not attacked.
Dewsbury	- 130 „	217 „	499 „
Other districts	147 „	205 „	623 „
	544 „	887 „	2,113 „

It should be added that six of those who were attacked with small-pox all of whom recovered, were stated to have previously suffered from it, as also were 120 who were not attacked on this occasion (*see* chart III. and XVI.). We have, therefore, an attack-rate amongst those stated to have previously suffered from small-pox of six out of 126, or 4·7 per cent.; and amongst those attacked for the first time of 881 out of 2,874, or 30·6 per cent. It will be seen subsequently that the liability to a second attack of the disease is about one-fifth of the liability obtaining amongst the vaccinated members of this community (24 per cent.), and about one-twelfth of that amongst the unvaccinated class (55·7 per cent.) It will also be seen that out of 257 persons known to have been re-vaccinated 3 were attacked with small-pox in this epidemic (*see* page 131), or an attack rate of 1·17 per cent.

Regarding the ages of these persons we find—

——	Attacked.	Previous Small-pox.	Not attacked.	Previous Small-pox.	Incidence Rates.	
					Whole Number.	Exclusive of previous Small-pox.
					Per cent.	Per cent.
Under 1 year - - - -	25	—	50	—	33·3	—
1 to 10 years - - - -	177	—	474	—	27·2	—
10 to 30 years - - - -	483	3	868	21	35·7	36·1
30 years and over - - -	202	3	700	99	22·4	24·9
Age not ascertained - - -	—	—	21	—	—	—
	887	6	2,113	120	29·5	30·6

TABLE XCVIII.

——	Attacked.	Previous Small-pox.	Not attacked.	Previous Small-pox.	Incidence.	
					Whole Number.	Exclusive of previous Small pox.
					Per cent.	Per cent.
Under 1 year - - - -	25	—	50	—	33·3	—
1– 5 years - - - - -	77	—	210	—	26·8	—
5–10 „ - - - - -	100	—	264	—	27·4	—
10–15 „ - - - - -	98	—	283	1	25·	25·5
15–20 „ - - - - -	161	1	264	2	37·8	37·8
20–30 . - - - - -	224	2	321	18	41·1	42·3
30–40 „ - - - - -	123	—	228	37	35·7	39·0
40–50 „ - - - - -	46	1	251	29	15·5	16·8
50–60 „ - - - - -	21	1	146	22	12·5	13·9
60–70 „ - - - - -	9	1	59	9	13·2	13·5
70 and over - - - - -	3	—	16	2	15·7	17·6
Age not ascertained - - -	—	—	21	—	—	—
	887	6	2,113	120	29·5	30·6

Vaccination and small-pox.

Thus the incidence of this disease was greatest amongst persons aged 20 to 30 years, the period which yielded the largest total number of all the periods named. There is a similar concordance between the proportion attacked with small-pox and those exposed to infection in the period 15 to 20 years.

—	In order of Numbers exposed.		In order of Incidence.		Exclusive of previous Small-pox.			
					In order of Numbers exposed.		In order of Incidence.	
	Age.	Number.	Age.	Per cent.	Age.	Number	Age.	Per cent.
1	20–30	546	20–30	41·1	20–30	525	20–30	42·2
2	15–20	425	15–20	37·8	15–20	422	30–40	39·8
3	10–15	381	30–40	35·4	10–15	380	15–20	37·8
4	5–10	364	Under 1	33·3	5–10	364	Under 1	33·3
5	30–40	351	5–10	27·4	30–40	313	5–10	27·4
6	40–50	297	1–5	26·8	1–5	287	1–5	26·5
7	1–5	287	10–15	25·7	40–50	267	10–15	25·5
8	50–60	167	40–50	15·5	50–60	144	70 and over 40–50	17·6 16·8
9	Under 1	75	70 and over	15·7	Under 1	75	50–60	13·9
10	60–70	68	60–70	12·5	60–70	59	60 to 70	13·5
11	70 and over	19	50–60	13·2	70 and over	17	—	—

We may analyse the foregoing statistics by dividing the community into two groups, viz., those belonging to the *unvaccinated* classes, and those belonging to the vaccinated and other classes previously described.

In the unvaccinated class there are 527 individuals of whom 294 were attacked with small-pox, a rate of 55·7 per cent. But of this number 50 had previously suffered from the disease, three of them again being attacked. Deducting these we have an incidence rate amongst the unvaccinated class of 61·7 per cent.

In the other classes there occurs a total of 2,473 individuals (viz.: vaccinated, 2,271, "under" vaccination 78, "alleged" vaccination 44, no information as to vaccination 80), of whom 593 were attacked with small-pox, an incidence rate of 23·9 per cent. Again deducting 76 (including three again attacked) who had previously suffered from small-pox, the rate would be 24·6 per cent.

Table XCIX.

—	Unvaccinated.						Other Classes.					
	Attacked.		Not attacked.		Incidence.		Attacked.		Not attacked.		Incidence.	
	Total.	Previous Small-pox.	Total.	Previous Small-pox.	On Whole Number.	Exclusive of Previous Small-pox.	Total.	Previous Small-pox.	Total.	Previous Small-pox.	On Whole Number.	Exclusive of Previous Small-pox.
					Per cent.						Per cent.	Per cent.
Under 1 year	17	—	26	—	39·5	—	8	—	24	—	25·	—
1–5 years	55	—	51	—	51·8	—	22	—	159	—	12·1	—
5–10 „	69	—	36	—	65·7	—	31	—	228	—	11·9	—
10–15 „	31	—	26	—	54·4	—	67	—	257	1	20·6	20·7
15–20 „	66	—	20	1	76·7	77·6	95	1	244	1	28·0	27·9
20–30 „	41	1	21	11	65·0	78·4	183	1	299	7	37·9	38·4
30–40 „	8	—	12	12	40·0	100·0	115	—	216	25	34·7	37·5
40–50 „	4	—	23	14	14·8	30·7	42	1	228	15	15·5	16·1
50–60 „	2	1	12	6	14·3	14·3	19	—	134	16	12·4	13·8
60–70 „	1	1	4	2	20·	—	8	—	55	7	12·7	14·3
70 and over	—	—	1	1	—	—	3	—	15	1	16·6	17·6
Age not ascertained	—	—	—	—	—	—	—	—	21	—	—	—
Total	294	3	233	47	55·7	61·7	593	3	1,880	73	23·9	24·6

Vaccination and small-pox.

Adopting the same method for illustrating the divergence in the order of each group as to total numbers and the incidence in turn of small-pox, it is seen that the relative positions are materially different in these groups from those taken by them as a whole.

UNVACCINATED.

—	In Order of Numbers exposed.		In Order of Incidence.		Exclusive of Previous Small-pox.			
					In Order of Numbers exposed.		In Order of Incidence.	
	Age.	Number.	Age.	Per cent.	Age.	Number.	Age.	Per cent.
1	1–5	106	15–20	76·7	1–5	106	30–40	10·0
2	5–10	105	5–10	65·7	5–10	105	20–30	78·4
3	15–20	86	20–30	65·0	15–20	85	15–20	77·6
4	20–30	63	10–15	54·4	10–15	57	5–10	65·7
5	10–15	57	1–5	51·8	20–30	51	10–15	54·4
6	Under 1	43	30–40	40·0	Under 1	43	1–5	51·8
7	40–50	27	Under 1	39·5	30–40	13	Under 1	39·5
8	30–40	20	60–70	20·	40–50	8	40–50	30·7
9	50–60	14	40–50	14·8	50–60	7	50–60	14·3
10	60–70	5	50–60	14·3	60–70	2	—	—
11	70 and over	1	—	—	—	—	—	—

which may be further contrasted with the remainder.

OTHER CLASSES.

—	In Order of Numbers exposed.		In Order of Incidence.		Exclusive of Previous Small-pox.			
					In Order of Numbers exposed.		In Order of Incidence.	
	Age.	Number.	Age.	Per cent.	Age.	Number.	Age.	Per cent.
1	20–30	482	20–30	37·9	20–30	474	20–30	38·4
2	15–20	339	30–40	34·7	15–20	337	30–40	37·5
3	30–40	331	15–20	28·0	10–15	323	15–20	27·9
4	10–15	324	Under 1	25·0	30–40	306	Under 1	25·
5	40–50	270	10–15	20·6	5–10	259	10·15	20·7
6	5–10	259	70 and over	16·6	40–50	254	70 and over	17·6
7	1–5	181	40–50	15·5	1–5	181	40–50	16·1
8	50–60	153	60–70	12·7	50–60	137	60–70	14·3
9	60–70	64	50–60	12·4	60–70	56	50–60	13·8
10	Under 1	32	1–5	12·1	Under 1	32	1–5	12·1
11	70 and over	18	5–10	11·9	70 and over	17	5–10	11·9

It will be observed that there is a fair concordance on the whole between the relative number of those exposed to infection in each age-period, and the proportion of those who were attacked, except in certain instances where the divergence is marked. Thus in the unvaccinated series, the proportion of the attacked was high compared with the numbers exposed in the period, 15 to 20 years; and low in the period, 1 to 5 years; and if those who had previously had small-pox be eliminated, a preponderant incidence is shown in the age-periods, 20 to 30, and 30 to 40. In the series of "other classes" there is a disproportionate incidence of attacks in the period "under one year," and "at 70 and over," *i.e.*, the two extremes of life; whilst in the age-period, 1 to 5 years, the incidence is again disproportionately low. The elimination of those who had previously suffered from small-pox makes but little change in these relations, except in the case of the age-period, 30 to 40, where the attack incidence is considerably raised thereby.

Of the whole number of 544 households, 295 contained one or more unvaccinated members, and it may be useful to contrast the incidence of small-pox in these families with that in the 249 of whom all the members were vaccinated or belonged to the other classes mentioned. Ranging these in two groups we have :—

Group A.—Households of whom no member was unvaccinated—249, comprising 1,272 individuals, of whom 355 were attacked with small-pox—a rate of 27 per cent. But 37 of these had previously suffered from small-pox (including two of those again attacked), and eliminating these the rate would be 28·5.

Group B.—Households of which one or more members were unvaccinated—295, comprising 1,728 individuals, of whom 532 were attacked with small-pox—a rate of 30·9 per cent. But 89 (including four who were again attacked) had previously suffered from small-pox, and eliminating them the rate would be 32·3 per cent.

Of the 1,728 persons, 527 were unvaccinated, and of these 294 contracted small-pox, 50 had previously suffered from it, including three again attacked.

Contrasting these groups in respect to the number of cases of small-pox occurring within them, it is found that in Group A. there were 180 households in which only one case of small-pox arose, or 72·3 per cent., and 69, or 27·7 per cent., had more than one case. In Group B. 175, or 59·2 per cent., had only one case, and 120, or 40·5 per cent., had more than one case.

Of the members of 355 households in which a single case of small-pox occurred, 1,437 were vaccinated, 35 were undergoing vaccination at time of exposure or attack, 28 were alleged to have been vaccinated but showed no evidence, 281 were unvaccinated, and in the case of 59 no information could be obtained—a total of 1,840.

Of the members of 189 households in which more than one case of small-pox occurred (amounting in all to 232), 834 were vaccinated, 43 were undergoing vaccination, 16 were alleged to have been vaccinated, 246 were unvaccinated, and of 21 no information on the point could be ascretained—a total of 1,160.

TABLE C.

—		Group A.	Group B.	Total.
Houses with single cases		180	175	355
Inmates	Attacked with small-pox	180	185	355
	Not attacked	690	795	1,485
	Total	870	970	1,840
Houses with multiple cases		69	120	189
Inmates	Attacked	175	357	532
	Not attacked	227	401	628
	Total	402	758	1,160
Total houses		249	295	544
Inmates	Attacked	355	532	887
	Not attacked	917	1,196	2,113
	Total	1,272	1,728	3,000

Vaccination and small-pox.

The above analysis shows that the incidence of small-pox in households not containing unvaccinated persons (Group A.) was 27·9 per cent.; in houses yielding one case each, 20·7 per cent.; in houses yielding more than one case, 43·5 per cent. Whereas in households containing one or more unvaccinated persons (Group B.) the incidence was 30·2 per cent.; in houses yielding single cases, 18 per cent.; in houses yielding more than one case, 47 per cent. Thus the greater proportion of the attacked—Group B.—in the multiple cases is to a certain extent counter-balanced by the greater proportion in Group A. in the "single" series.

The same facts may be dealt with from another side, viz., the relative proportions of the vaccinated and unvaccinated in the houses having single and multiple cases.

Three hundred and fifty-five houses yielding single cases contained 281 unvaccinated persons and 1,559 belonging to the "other classes" (1,437 vaccinated) here indicated.

One hundred and eighty-nine houses yielding multiple cases contained 246 unvaccinated persons and 914 of the "other classes" (834 vaccinated).

Distributing the number of attacks in each of these groups we have, dealing with the *vaccinated* and *unvaccinated*:—

	Houses with single Cases.			Houses with multiple Cases.		
—	Attacked.	Not attacked.	Rate.	Attacked.	Not attacked.	Rate.
			Per cent.			Per cent.
Unvaccinated	109	172	38·8	185	61	71·1
Vaccinated	232	1,205	16·1	312	522	37·4

In other words, in the houses which yielded single cases, 68 per cent. of those attacked were vaccinated subjects, and 32 per cent. unvaccinated.

In the houses yielding multiple cases 63 per cent. were vaccinated and 37 per cent. unvaccinated.

By excluding the "initial" cases in each multiple series there would be 159 vaccinated and 99 unvaccinated, or an incidence of 23·3 per cent. in the former and 61·8 per cent. in the latter, whereas the proportionate attacks were 61·6 vaccinated, and 38·4 unvaccinated.

Reverting to Groups A. and B., viz., those houses in which no persons were unvaccinated, and those in which one or more were known to be unvaccinated, one may contrast them more in detail as to the relative number of individuals in the houses in proportion to those attacked therein. No house contained more than 11 inmates, and one dwelling was inhabited by a single person only. Between these limits the households are distributed, and it will be evident from the subjoined table that in Group B. there is a greater proportion of large households and a less proportion of small households than in Group A.:—

TABLE CI.

Size of Household.	Group A.				Group B.			
	249 Houses.				294 Houses.			
	No. of Houses.	Per cent.	Inmates.		No. of Houses.	Per cent.	Inmates.	
			Attacked.	Not attacked.			Attacked.	Not attacked.
11	4	1·6	6	38	7	2·3	12	65
10	6	2·4	14	46	13	4·4	40	90
9	11	4·4	23	76	16	5·4	32	112
8	19	7·6	32	120	24	8·1	61	131
7	22	9·2	39	115	38	12·6	74	192
6	34	13·6	51	153	57	19·3	106	236
5	38	15·2	47	143	57	19·3	96	189
4	50	20·	67	133	52	17·7	73	135
3	40	16·	45	75	22	7·4	26	40
2	24	9·6	30	18	9	3·	12	6
1	1	0·4	1	—	—	—	—	—
—	249	—	355	917	295	—	532	1,196

Vaccination and small-pox.

To appreciate more fully the relative incidence of the disease upon the unvaccinated and other classes, we may further analyse Group B., *i.e.*, those invaded households which contained one or more unvaccinated members.

1st.—In 175 households in which a single case of small-pox occurred, 281 of the 970 members were unvaccinated; whereas those attacked comprised 109 unvaccinated subjects, and 66 belonging to the "other classes" (viz.:—62 vaccinated, two "under" vaccination, and two "alleged" vaccination). Here, then, the incidence was:—

Unvaccinated, whole number, 281; attacked, 109; rate, 38.7 per cent.

Other classes, whole number, 689; attacked, 66; rate, 9.5 per cent.

But 36 of the unvaccinated class (including two again attacked) had previously suffered from small-pox, so that eliminating these we have—

Unvaccinated, whole number, 245; attached, 107; rate, 43·6 per cent.

Turning now to the "multiple" series, we have 120 households containing 758 members, of whom 246 were unvaccinated. Those who were attacked with small-pox comprised 185 unvaccinated subjects, and 173 belonging to the other classes (viz.: 155 vaccinated, eight "under" vaccination, seven "alleged" vaccination, and three of whom no information as to vaccination could be obtained).

The "initial" cases arising in these houses must be distinguished from the "later" cases, *i.e.*, those who were attacked first (or within a few days of one another, if more than one) and those attacked subsequently, and for the most part secondarily to the initial case. There were 161 such initial cases, and 195 later cases, the incidence being:—

Unvaccinated, whole number, 246; initial cases, 85; later cases, 100.

Other classes, whole number, 512; initial cases, 76; later cases, 96.

The rate of incidence upon the *later cases only*, was for the unvaccinated 161: 100, or 62·1 per cent.

Other classes, 436: 96, or 22 per cent.

Again deducting from the unvaccinated class those who had previously suffered from small-pox, viz., 12—we have an incidence rate of the later cases in those households among the unvaccinated, of 149: 100, or 67·1 per cent.

This part of the subject may be completed by the following tables, showing (*a*) the numbers attacked and not attacked in the households containing unvaccinated inmates ranged according to the number of inmates in each house; (*b*) the numbers of individuals attacked and not attacked in Group A. arranged according to their ages, and (*c*) a similar table of those in Group B.

TABLE CII.

No. of Houses.	No. of Inmates per House.	Unvaccinated.				Other Classes.			
		Attacked.	Previous Small-pox.	Not attacked.	Previous Small-pox.	Attacked.	Previous Small-pox.	Not attacked.	Previous Small-pox.
7	11	6	—	14	3	6	—	51	—
13	10	18	—	11	1	22	—	79	2
16	9	17	—	17	2	15	—	95	—
24	8	32	—	22	5	29	—	109	7
38	7	41	—	35	7	33	—	157	5
57	6	56	—	47	10	50	1	189	13
57	5	58	—	42	8	38	—	147	8
52	4	44	1	31	5	29	—	104	1
22	3	15	1	11	2	11	—	29	4
9	2	7	—	3	3	5	—	3	2
294	—	294	2	433	46	238	1	963	42

TABLE CIII.

GROUP A.—249 households, containing 1,272 inmates, of whom none were unvaccinated:—

—	Attacked.	Previous Small-pox.	Not attacked.	Previous Small-pox.	Total.
Under 1 year	4	—	16	—	20
1–5 years	14	—	67	—	81
5–10 „	19	—	109	—	128
10–15 „	36	—	114	1	150
15–20 „	57	1	133	1	190
20–30 „	115	1	157	2	272
30–40 „	68	—	93	10	161
40–50 „	21	—	93	7	114
50–60 „	12	—	80	11	92
60–70 „	7	—	34	3	41
70 and over	2	—	6	—	8
Age not ascertained	—	—	15	—	15
	355	2	917	35	1,272

Or at age periods:—

—	Attacked.	Previous Small-pox.	Not attacked.	Previous Small-pox.	Total.
Under 1 year	4	—	16	—	20
1–10 years	33	—	176	—	209
10–30 „	208	2	404	4	612
30 and over	110	—	306	31	416
Age not ascertained	—	—	15	—	15
	355	2	917	35	1,272

Vaccination and small-pox.

TABLE CIV.

GROUP B.—295 households, containing 1,728 inmates (one or more of whom in each house were unvaccinated).

—	Unvaccinated.				Other Classes.				Total.
	Attacked.	Previous Small-pox.	Not attacked.	Previous Small-pox.	Attacked.	Previous Small-pox.	Not attacked.	Previous Small-pox.	
Under 1 year -	17	—	26	—	4	—	8	—	55
1–5 years - -	55	—	51	—	8	—	92	—	206
5–10 „ - -	69	—	36	—	12	—	119	—	236
10–15 „ - -	31	—	26	—	31	—	143	—	231
15–20 „ - -	66	—	20	1	38	—	111	—	235
20–30 „ - -	41	1	21	11	68	—	142	5	273
30–40 „ - -	8	—	12	12	47	—	123	15	190
40–50 „ - -	4	—	13	14	21	1	135	8	183
50–60 „ - -	2	1	12	6	7	—	54	5	75
60–70 „ - -	1	1	4	2	1	—	21	4	27
70 and over - -	—	—	1	1	1	—	9	1	11
Age not ascertained	—	—	—	—	—	—	6	—	6
	294	3	233	47	238	1	963	38	1,728

Or at age periods:—

—	Unvaccinated.				Other Classes.				Total.
	Attacked.	Previous Small-pox.	Not attacked.	Previous Small-p ox	Attacked.	Previous Small-pox.	Not attacked.	Previous Small-pox.	
Under 1 year -	17	—	26	—	4	—	8	—	55
1–10 years - -	124	—	87	—	20	—	211	—	442
10–30 „ - -	138	1	68	12	137	—	396	5	739
30 and over - -	15	2	52	35	77	1	342	33	486
Age not ascertained	—	—	—	—	—	—	6	—	6
	294	3	233	47	238	1	963	38	1,728

Vaccination and Measures of Isolation.

It still remains to consider the question of the incidence of small-pox upon the vaccinated and unvaccinated respectively in regard to the greater or less liability to infection from the non-adoption or adoption of measures of isolation. This subject has been treated under each of three divisions of the district here dealt with, but it will be useful to collate the information there supplied.

We must, therefore, once more divide the various households into groups, according to the degree of isolation measures practised; and these, again, must be dealt with in relation to the number of cases arising in the households. Now, it will be obvious that to properly estimate the influence of hospital isolation in protecting the remaining members of a family from infection, it will not do merely to group together the households with single cases and then these with multiple cases, since in several of the latter the individuals attacked fell ill within a few days of one another. I have in the previous pages, therefore, distinguished between what I have termed the "initial" cases, and the "later" cases, the former including several members of the same family who could not fairly be said to have been infected by the first case. With this explanation, we may divide the 544 househoulds into two main groups, one comprising 388 houses with 2,025 inmates, being those in which the cases were not followed by any subsequent ones; the other comprising 156 houses, with 975 inmates, containing multiple cases of which some may be regarded as initial attacks, others as "later attacks."

——	Attacked.		Not Attacked.	Total.
GROUP I.				
355 houses with single cases -	355		1,485	1,840
33 houses with multiple cases	85		100	185
GROUP II.	Initial.	Later.		
156 houses with multiple cases.	173	274	528	975

Dividing each of these groups according to whether the initial case (or cases) was kept at home or removed to hospital we have:—

GROUP I. (Single and Multiple Cases).

—	Initial Case Removed.	Initial Case Remained	Total.
Number of houses - - -	271	117	388
Attacked - - - -	315	125	440
Not attacked - - - -	1,172	413	1,585
Total - - -	1,487	538	2,025

Vaccination and small-pox.

GROUP II. (Multiple Cases).

——	Initial Case Removed.	Initial Case Remained	Total.
Number of houses	84	72	156
Attacked, initial	91	82	173
„ later	147	127	274
Not attacked	292	236	528
Total	530	445	975

Group II. may be further divided according as to whether the "later" cases were kept at home or removed, in which case we have the three series A, B, C, defined in Batley Report (p. 49), viz. :—

Group II.	Series A.	Series B.	Series C.	Total.
Number of houses	84	25	47	156
Attacked, initial	91	27	55	173
„ later	147	43	84	274
Not attacked	292	90	146	528
Total	530	160	285	975

The attack rates are then for :—

Group I. (all cases) 21·7 per cent.—
Initial removed, 21·2 per cent.
,, remained, 23·2 per cent.
Group II. (later cases only, exclusive of initial cases), 34·1 per cent.
Series A. (initial case removed), 33·5 per cent.
Series B. (initial case remained, later cases removed), 32·3 per cent.
Series C. (both initial and later cases remained), 36·5 per cent.

These results may be further analysed according to the vaccination relations of the individuals concerned. In order to make these returns clearly comprehensible I will once more give in the first place the analysis, as to vaccination, &c., of the whole number of households, indicating in addition to previous particulars, the numbers of the vaccinated community who were successfully re-vaccinated :—

——	Attacked.	Not Attacked.	Total.
Vaccinated	544	1,727	2,271
Re-vaccinated, before house infected	6	31	37
Re-vaccinated, on or after house infected	*4	218	222
Previous small-pox	2	64	66
Under vaccination	21	57	78
Alleged vaccination	24	20	44
Previous small-pox	–	2	2
No information as to vaccination	4	76	80
Previous small-pox	1	7	8
Unvaccinated	294	233	257
Previous small-pox	3	47	50
Total	887	2,113	3,000

* One case exposed to infection away from house (Pa. 237).

Re-vaccinated* :—

Recent { Successful - - 240 (1 attacked).
Recent { Unsuccessful - 80 (3 attacked).
Previous years - 17 (2 attacked).

ATTACK RATES.

—	All Persons.			Exclusive of those who had Small-pox previously.		
	Total No.	Attacks.	Rate.	Total No.	Attacks.	Rate.
			Per cent.			Per cent.
Vaccinated	2,271	544	23·9	2,205	542	24·5
Under vaccination	78	21	27·	78	21	27·
Alleged vaccination	44	24	54·5	42	24	57·1
No information as to vaccination.	80	4	5·	72	3	4·1
Unvaccinated	527	294	55·7	477	291	61·

The figures given in the foregoing table may be apportioned between the two groups above defined, viz. : Group I., 388 households, in which single cases of small-pox occurred, and multiple cases sickening within a few days of one another; and Group II., 156 households of multiple cases, some of which (in each house) were obviously infected by the first or initial cases.

——	Group I.			Group II.			
	388 Households.			156 Households.			
	Attacked.	Not Attacked.	Total.	Attacked.		Not Attacked.	Total.
				Initial.	Later.		
Vaccinated	288	1,296	1,584	103	153	451	687
Re-vaccinated, before house infected	1	23		—	5	8	37
Re-vaccinated, on or after house infected	1	154		—	3	64	222
Previous small pox	1	50			1	14	
Under vaccination	8	35	43	1	12	22	35
Alleged vaccination	13	18	31	4	7	2	13
Previous small-pox		2					
No information as to vaccination	1	58	59	—	3	18	21
Previous small-pox	1	5				2	
Unvaccinated	130	178	308	65	99	55	219
Previous small-pox	3	35				12	
	440	1,585	2,025	173	274	528	975

Re-vaccination, Recent { Successful - - 177 - - 63 (one attacked).
Re-vaccination, Recent { Unsuccessful - - 159 (two attacked) 21 (one attacked).
Previous years - 12 - - 5 (two attacked ,

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* *It will be obvious that in this and in the similar analyses in the Report the "re-vaccinated" included in the tables only comprise those who were re-vaccinated during the present outbreak.*

Vaccination and small-pox.

ATTACK RATES.

GROUP I.

—	All Persons.			Exclusive of those who had Small-pox previously.		
	Total No.	Attacks.	Rate.	Total No.	Attacks.	Rate.
			Per cent.			Per cent.
Vaccinated	1,584	288	18·2	1,533	287	18·7
Under vaccination	43	8	18·6	43	8	18·6
Alleged vaccination	31	13	41·9	29	13	44·8
No information	59	1	—	54	—	—
Unvaccinated	308	130	42·2	270	127	47·0

GROUP II. (exclusive of Initial Cases.)

—	Total No.	Attacks.	Rate.	Total No.	Attacks.	Rate.
			Per cent.			Per cent.
Vaccinated	584	153	26·2	569	152	26·7
Under vaccination	34	12	35·3	34	12	35·3
Alleged vaccination	9	7	73·3	9	7	73·3
No information	21	3	14·3	19	3	15·8
Unvaccinated	154	99	64·2	142	99	69·

The initial cases of small-pox were removed to hospital (or infirmary) from 355 houses, 271 of which fall into Group I. and 84 into Group II.

In those in Group I., containing 1,487 inmates, there were 315 attacked with small-pox; 64 of those who escaped had previously suffered from the disease, as also had three of those who were again attacked. As regards their vaccination relations, 1,135 were vaccinated, of whom 194 were attacked; or, subtracting those who had previously suffered, the numbers would be 1,100 and 193 respectively. The incidence, then, on the vaccinated in this group is 16·2 per cent., or, exclusive of those who previously had small-pox, 17·5 per cent.

Nineteen were under vaccination, of whom five were attacked, an incidence rate of 26·3 per cent.

Twenty-five were said to have been vaccinated, but showed no evidence of this, and 10 of these were attacked, or 40 per cent., and, excluding one who had previously suffered, 41·6 per cent.

In the cases of 47 no information was obtainable as to vaccination; six had previously suffered from small-pox, including the one who was again attacked.

Lastly, 261 were unvaccinated, and 26 had previously had small-pox; 105 were attacked, one for the second time. The incidence rate of these was therefore 40·2 per cent., or, excluding those who had previously suffered, 44·2 per cent.

Group II. embraces 530 individuals, of whom 238 were attacked, 91 of these being considered "initial" cases, and 147 as "later" cases. 356 were vaccinated, of whom 125 were attacked (50 initial, 75 later), and nine had previously had small-pox. The incidence rates—*for the later cases only*—were then:—75 : 306, or 24·5 per cent., and excluding those who had previously had small-pox, 75 : 297, or 25·2 per cent.

Twenty were "under" vaccination, of whom eight were attacked (one initial, seven later), the incidence of the later cases only being 7 : 19, or 36·8 per cent.

Five were alleged to have been vaccinated, of whom four were attacked (two initial, two later); the incidence of the later cases being therefore 2 : 3, or 66·6 per cent.

None of the 11 cases, of whom no information as to vaccination was obtained, were attacked with small-pox.

Lastly, 138 were unvaccinated, of whom, 101 (38 initial, 63 later) were attacked with small-pox, and five had previously suffered from the disease. The incidence of the later cases was therefore 63 : 100, or 63 per cent., and excluding those who had previously had small-pox, 63 : 95, or 66·3 per cent.

It may be of interest to contrast the incidence of the disease in dealing with the *initial* cases only in each case, thus:—

Vaccinated, Group I., rate, 16·2 per cent., or excluding previous small-pox, 17·5 per cent.

Vaccinated, Group II., rate, 17·7 per cent., or excluding previous small-pox, 18·3.

Under vaccination, Group I., rate, 26·3 per cent.

" " Group II., rate, 5 per cent.

Alleged vaccination, Group I., rate, 40 per cent., or excluding previous small-pox, 41·67 per cent.

Alleged vaccination, Group II., rate, 40 per cent.

Unvaccinated, Group I., rate, 40·2 per cent., or excluding previous small-pox, 44·2 per cent.

Unvaccinated, Group II., rate, 50·6 per cent., or excluding previous small-pox, 54·3 per cent.

Thus both amongst the vaccinated and unvaccinated the incidence of small-pox was greater in the households where cases subsequently arose; the disproportion being, however, larger in the case of the unvaccinated than in that of the vaccinated.

INITIAL CASES REMOVED TO HOSPITAL.

—	Group I.			Group II. (Series A.).				—
	271 Households.			84 Households.				
	Attacked.	Not Attacked.	Total.	Attacked.		Not Attacked.	Total.	
				Initial.	Later.			
Vaccinated	194	941	1,135	50	75	231	356	1,491
Re-vaccinated before house infected	1	8		2	1	7		19
Re-vaccinated on or after house infected	—	92		—	2	43		137
Previous small-pox	1	34				9		44
Under vaccination	5	14	19	1	7	12	20	39
Alleged vaccination	10	15	25	2	2	1	5	30
Previous small-pox		1				—		1
No information as to vaccination	1	46	47	—	—	11	11	58
Previous small-pox	1	5				—		6
Unvaccinated	105	156	261	38	63	37	138	399
Previous small-pox	1	25				5		31
	315	1,172	1,487	91	147	292	530	2,017

Vaccination and small-pox.

ATTACK RATES.

—	Group I.			Group I. (exclusive of those who had had Small-pox previously).		
	Total No.	Attacks.	Rate.	Total No.	Attacks.	Rate.
			Per cent.			Per cent
Vaccinated	1,135	194	16·2	1,100	193	17·5
Under vaccination	29	5	26·3	—	—	—
Alleged vaccination	25	10	40·	24	10	41·6
No information	47	1	2·1	41	—	—
Unvaccinated	261	105	40·2	235	104	44·2

—	Group II.					Group II. (exclusive of those who had had Small-pox previously.)				
	Total No.	Attacks.		Rates.		Total No.	Attacks.		Rates.	
		Initial.	Later.	Initial only.	Later only.		Initial.	Later.	Initial.	Later.
				Per cent.	Per cent.				Per cent.	Per cent.
Vaccinated	356	50	75	17·7	24·5	347	50	75	18·3	25·2
Under vaccination	20	1	7	5·	36·8	—	—	—	—	—
Alleged vaccination	5	2	2	40·	66·6	—	—	—	—	—
No information	11	—	—	—	—	—	—	—	—	—
Unvaccinated	138	38	63	50·6	63·	135	38	63	54·3	66·3

The foregoing figures may be contrasted with those relating to the households in which the first cases (at least) of small-pox arising therein were retained in their homes. The same separation into Groups I. and II. may here be made, but Group II. requires to be sub-divided according as to whether some or all of the latter cases were removed to hospital (*i.e.*, Series B.), or whether they were all kept at home (*i.e.*, Series C.).

In Group I. there are 538 individuals, of whom 125 were attacked with small-pox. Of them 29 had previously had the disease, including two who were again attacked with it. Of this number 449 were vaccinated, 16 having previously had small-pox; 94 were attacked with small-pox, a rate of 20·9 per cent., or excluding those who had previously suffered of 21·7 per cent.

There were 24 "under" vaccination, of whom three were attacked, a rate of 12·5 per cent. Six are of the "alleged" class, of whom three were attacked, *i.e.*, 50 per cent.; but one had previously suffered, and excluding this case the rate would be 60 per cent. No attacks occurred among the 12 of whom no information as to vaccination was obtained.

Forty-seven were unvaccinated, 25 being attacked; 12 had previously had small-pox, including two who again were attacked. The incidence was, therefore, 25 : 47, or 53·2 per cent.; and exclusive of previous small-pox 23 : 35, or 65·7 per cent.

In Group II., Series B., there are 160 individuals, of whom 70 were attacked with small-pox, six had previously suffered from it. Of these 126 were vaccinated, 46 of them being attacked (18 initial, 28 later). The incidence on the initial cases only was therefore 18 : 98, or 18·3 per cent.; on the later cases only 28 : 108, or 25·9 per cent. Excluding four who had previously had small-pox the rates are: initial, 19·1 per cent.; later, 26·9 per cent.

There are 31 unvaccinated, of whom 23 were attacked (nine initial, 14 later), and two had previously had small-pox. The incidence on the initial cases was therefore 9 : 17, or 53 per cent.; on the later cases, 14 : 22, or 63·6 per cent.; and excluding the two who had previously suffered, initial, 60 per cent.; later, 70 per cent.

In Group II., Series C., there are 285 individuals, of whom 139 were attacked with small-pox; nine had previously had it. Of these 205 were *vaccinated*, 85 being attacked (35 initial, 50 later). The incidence on the initial cases only was therefore 35 : 155, or 22·5 per cent.; and on the later cases only 50 : 170, or 29·4 per cent. Excluding the two cases of previous small-pox (one being again attacked) the rates are, initial, 22·8 per cent.; later, 29·1 per cent.

Thirteen were *under vaccination*, of whom four (all "later" cases) were attacked, a rate of 30·7 per cent.; eight were *alleged*, of whom seven were attacked (two initial, five later), or an incidence for initial cases of 2 : 3, or 66·6 per cent.; and for later cases of 5 : 6, or 43·3 per cent.

There are nine of whom no information as to vaccination could be obtained, and three of these (all later cases) were attacked. Two of those who escaped had previously suffered from small-pox.

Fifty were unvaccinated, of whom 40 were attacked (18 initial, 22 later), and five of the rest had previously suffered. The incidence on initial cases was, therefore, 18 : 28, or 64·2 per cent.; in later cases, 22 : 32, or 68·7 per cent. And excluding those previously attacked, it was for initial cases, 78·2 per cent.; for later cases, 81·4 per cent.

Vaccination and small-pox.

INITIAL CASES REMAINED AT HOME.

—	Group I.			Group II.								—
	117 Households.			(Series B.) 25 Households.				(Series C.) 47 Households.				
	At-tacked.	Not at-tacked.	Total.	Attacked. Initial.	Attacked. Later.	Not at-tacked.	Total.	Attacked. Initial.	Attacked. Later.	Not at-tacked.	Total.	
Vaccinated	94	355	449	18	28	80	126	35	50	120	205	780
Re-vaccinated – before house infected	—	15		—	—	—		—	2	1		13
Re-vaccinated – on or after house infected	1	62		—	—	2		—	1	19		35
Previous small-pox		16				4			1	1	8	23
Under vaccination	3	21	24	—	1	1	2		4	9	13	39
Alleged vaccination	3	3	6	—	—	—	—	2	5	1	8	14
Previous small-pox		1				—						1
No information as to vaccination	—	12	12	—	—	1	1	—	3	6	9	22
Previous small-pox		—				—				2		2
Unvaccinated	25	22	47	9	14	8	31	18	22	10	50	128
Previous small-pox	2	10				2				5	—	19
	125	413	538	27	43	90	160	55	84	146	285	983

Type of Small-Pox in relation to Vaccination Condition of those attacked.

The cases of small-pox may be divided into groups according to the extent of the eruption and severity of attack as follows :—

TABLE CV.

—	Confluent.		Coherent.		Discrete.		Mild.		Type uncertain.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Vaccinated	44	14	59	—	260	1	256	—	8	1
No information as to vaccination	1	0	1	—	2	—	2	—	4	—
Alleged vaccination	9	2	4	—	8	—	4	—	—	—
"Under" vaccination	8	3	3	—	1	—	8	—	1	—
Unvaccinated	211	86	58	—	62	2	13	—	2	1
	273	105	125	—	333	3	283	—	15	2

Among the *vaccinated* :—

7 per cent. had confluent attacks.
9·4 ,, coherent ,,
41·4 ,, discrete ,,
40·8 ,, mild ,,

Among the *unvaccinated* :—

61 per cent. had confluent attacks.
16·7 ,, coherent ,,
17·9 ,, discrete ,,
3·7 ,, mild ,,

Of those "*alleged to have been vaccinated* :—

36 per cent. had confluent attacks.
16 ,, coherent ,,
32 ,, discrete ,,
16 ,, mild ,,

Of those who were "*undergoing vaccination*" :—

38·1 per cent. had confluent attacks.
14·3 ,, coherent ,,
4·4 ,, discrete ,,
28·1 ,, mild ,,

And conversely—

Of the *confluent* cases :—

16·1 per cent. were vaccinated.
3·3 ,, "alleged" to have been vaccinated.
2·9 ,, "under vaccination."
77·2 ,, unvaccinated.

Of the *coherent* cases :—

47·2 per cent. were vaccinated.
3·2 ,, "alleged to be vaccinated."
2·4 ,, "under" vaccination.
46·2 ,, unvaccinated.

Of the *discrete* cases :—

78 per cent. were vaccinated.
2·4 ,, "alleged to be vaccinated."
0·3 ,, "under" vaccination.
18·6 ,, unvaccinated.

Of the *mild* cases :—

90·4 per cent. were vaccinated.
1·4 ,, "alleged to be vaccinated."
2·8 ,, "under" vaccination.
4·5 ,, unvaccinated.

CONFLUENT TYPE.

There were 273 cases of this type, including three which were also hæmorrhagic. Of this number 105 were fatal, or 38·4 per cent.; and 81·9 per cent. of the deaths were in unvaccinated subjects. The ages of these cases are given in the subjoined table:—

TABLE CVI.

—	Vaccinated.		No Information on Vaccination.		Alleged Vaccination.		"Under" Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	—	—	—	—	—	—	4	3	16	15	20	18
1 to 5 years	1	—	—	—	—	—	1	—	30	20	32	20
5 to 10 ,,	—	—	—	—	1	—	2	—	41	15	44	15
10 to 15 ,,	1	—	—	—	—	—	—	—	22	3	23	3
15 to 20 ,,	2	2	—	—	4	—	1	—	46	7	53	9
20 to 30 ,,	14	3	1	—	1	1	—	—	38	17	54	21
30 to 40 ,,	14	6	—	—	1	—	—	—	10	3	25	9
40 to 50 ,,	6	1	—	—	1	1	—	—	6	5	13	7
50 to 60 ,,	4	2	—	—	1	—	—	—	1	1	6	3
60 to 70 ,,	2	—	—	—	—	—	—	—	—	—	2	—
70 and over	—	—	—	—	—	—	—	—	—	—	—	—
Age not ascertained.	—	—	—	—	—	—	—	—	1	—	1	—
	44	14	1	—	9	2	8	3	211	86	273	105

Vaccination and small-pox.

They may be summarised as follows :—

	Cases		Deaths		Mortality
Under 1 year,	20	cases,	18	deaths,	or 90 per cent. mortality.
1 to 10 years,	76	„	35	„	or 46 per cent. mortality,
10 to 30 „	130	„	33	„	or 25·3 per cent. mortality.
30 and over	46	„	19	„	or 41·3 per cent. mortality.
Age not ascertained	1	„	0	„	
	273		105		

Coherent Type.

There were 125 cases of this type, none of which were fatal. Their age distribution is given in the subjoined table :—

Table CVII.

—	Vaccinated.		No Information as to Vaccination.		Alleged Vaccination.		Under Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year -	—	—	—	—	—	—	1	—	1	—	2	—
1 to 5 years -	—	—	—	—	—	—	1	—	11	—	12	—
5 to 10 „ -	—	—	—	—	—	—	—	—	12	—	12	—
10 to 15 „ -	1	—	—	—	2	—	1	—	5	—	9	—
15 to 20 „ -	13	—	—	—	—	—	—	—	19	—	32	—
20 to 30 „ -	24	—	—	—	1	—	—	—	9	—	34	—
30 to 40 „ -	13	—	—	—	—	—	—	—	1	—	14	—
40 to 50 „ -	4	—	1	—	—	—	—	—	—	—	5	—
50 to 60 „ -	1	—	—	—	1	—	—	—	—	—	2	—
60 to 70 „ -	2	—	—	—	—	—	—	—	—	—	2	—
70 and under -	—	—	—	—	—	—	—	—	—	—	—	—
Age not ascertained.	1	—	—	—	—	—	—	—	—	—	1	—
	59	—	1	—	4	—	3	—	58	—	125	—

They may be summarised as follows :—

Under 1 year of age	- - -	2 cases.
1 to 10 years	- - - -	24 „
10 to 30 „	- - - -	75 „
30 years and over	- - -	23 „
Age not ascertained	- - -	1 „
		125

Discrete Type.

There were 333 cases of this type, three of which were fatal. Their age distribution is given in the subjoined table :—

Table CVIII.

—	Vaccinated.		No Information as to Vaccination.		Alleged Vaccination.		Under Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year -	1	—	—	—	—	—	—	—	2	—	3	—
1 to 5 years -	3	—	1	—	—	—	—	—	13	2	17	2
5 to 10 „ -	5	1	—	—	—	—	—	—	20	—	25	1
10 to 15 „ -	29	—	—	—	2	—	1	—	12	—	44	—
15 to 20 „ -	37	—	—	—	1	—	—	—	9	—	47	—
20 to 30 „ -	96	—	—	—	3	—	—	—	4	—	103	—
30 to 40 „ -	54	—	—	—	2	—	—	—	—	—	56	—
40 to 50 „ -	21	—	1	—	—	—	—	—	—	—	22	—
50 to 60 „ -	11	—	—	—	—	—	—	—	1	—	12	—
60 to 70 „ -	2	—	—	—	—	—	—	—	—	—	2	—
70 years and over	—	—	—	—	—	—	—	—	1	—	1	—
Age not ascertained.	1	—	—	—	—	—	—	—	—	—	1	—
	260	1	2	—	8	—	1	—	62	2	333	3

They may be summarised as follows :—

Under 1 year	- -	3 cases,	no deaths.
1 to 10 years	- -	42 „	3 „
10 to 30 „	- -	194 „	no „
30 years and upwards	-	93 „	„ „
Age not ascertained	-	1 „	—
		333	3

The following is a list of the three fatal cases occurring amongst those who had this comparatively mild form of the disease :—

Table CIX.

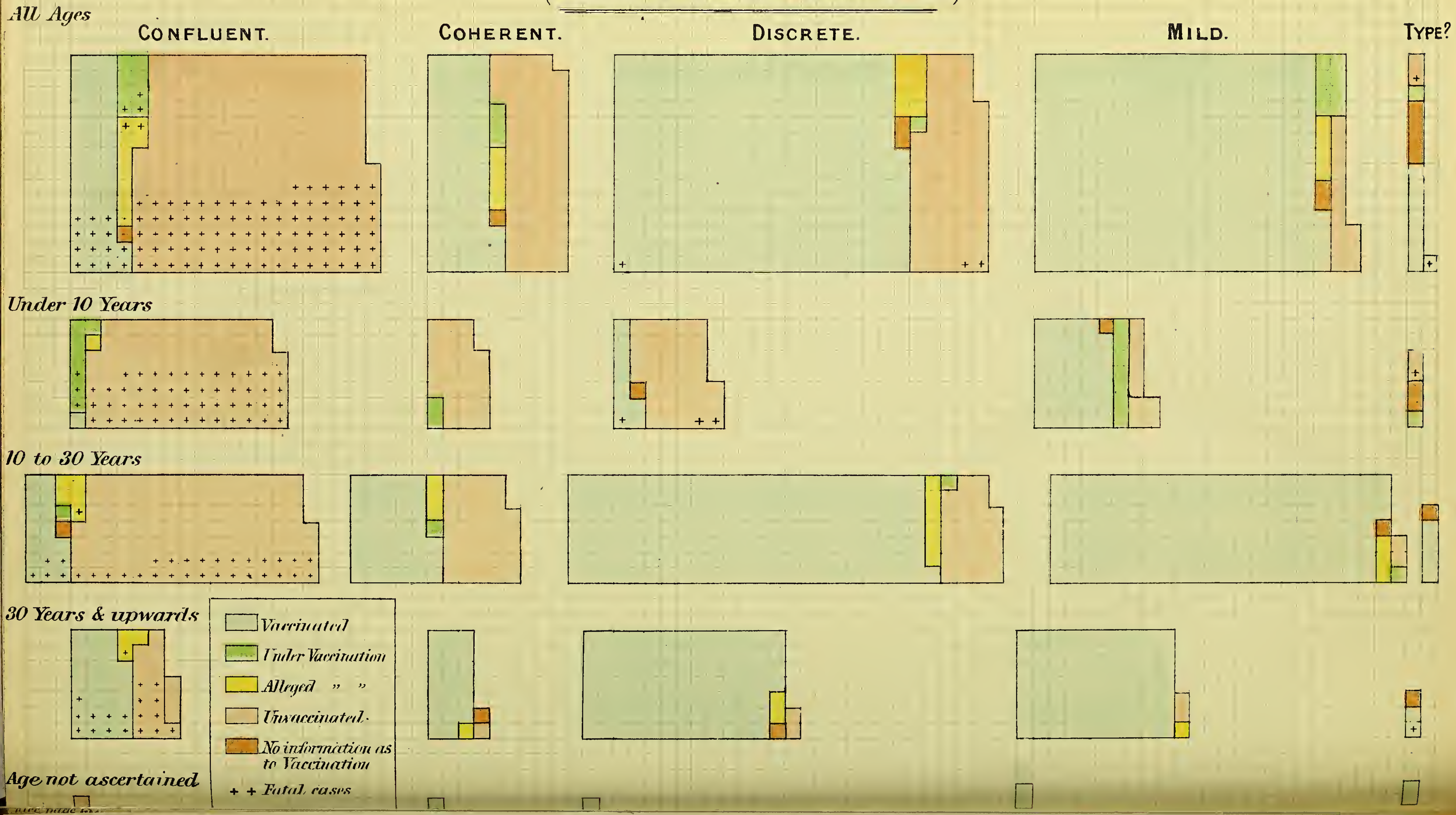
Deaths among Subjects of Discrete Small-pox.

Reference to Register.	Name.	Sex.	Age.	Onset.	Rash.	Date of Death.	Duration.	Cause of Death.
Batley, 314 - - - -	H. C. -	M.	3	Feb. 10 -	Feb. 12 -	Feb. 26 -	17 days -	Bronchitis.
„ 348 - - - - -	G. C. -	M.	1	Feb. 19 -	Feb. 22 -	Feb. 28 -	20 „ -	„
„ 544 - - - - -	N. H. -	M.	7	May 21 -	May 23 -	July 3 -	6 weeks -	Epilepsy.

These three children cannot be said to have died from small-pox primarily, although the attack may have contributed to diminish their vital resistance. Two of them were unvaccinated subjects, and succumbed to bronchitis, after the rash had subsided, and convalescence from small-pox was established. The third was an epileptic, and died in an attack of that disease. He had long been convalescent from small-pox when the fatal seizure took place.

Chart XIX.

TYPE AND FATALITY OF SMALL POX IN REGARD TO AGE AND VACCINATION, (ALL CASES IN THE DEWSBURY UNION.)



Vaccinati and small pox.

MILD TYPE.

This type, which includes those ordinarily described as "varioloid," and many in which the diagnosis of small-pox would have been doubtful had the cases not occurred in members of households side by side with other undoubted cases, includes 283 individuals, whose ages are subjoined:—

TABLE CX.

—	Vaccinated.		No Information as to Vaccination.		Alleged Vaccination.		Under Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	—	—	—	—	—	—	2	—	1	—	3	—
1 to 5 years	12	—	1	—	—	—	3	—	4	—	20	—
5 to 10 „	22	—	—	—	—	—	2	—	4	—	28	—
10 to 15 „	32	—	—	—	—	—	—	—	—	—	32	—
15 to 20 „	43	—	1	—	1	—	—	—	1	—	46	—
20 to 30 „	75	—	—	—	2	—	1	—	1	—	79	—
30 to 40 „	43	—	—	—	—	—	—	—	—	—	43	—
40 to 50 „	17	—	—	—	—	—	—	—	1	—	18	—
50 to 60 „	6	—	—	—	—	—	—	—	—	—	6	—
60 to 70 „	2	—	—	—	—	—	—	—	1	—	3	—
70 years and over	2	—	—	—	1	—	—	—	—	—	3	—
Age not ascertained.	2	—	—	—	—	—	—	—	—	—	2	—
	256	—	2	—	4	—	8	—	13	—	283	—

They may be summarised as follows:—

Under 1 year	3 cases.
1 to 10	48 „
10 to 30	157 „
30 years and over	73 „
Age not ascertained	2 „
	283 „

TYPE UNCERTAIN.

There were 15 cases of which I was unable to get sufficient details to assign them a place under each of the foregoing heads. They are given in the subjoined table, and comprise two fatal cases:—

TABLE CXII.

—	Vaccinated.		No Information as to Vaccination.		Alleged Vaccination.		"Under" Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	—	—	—	—	—	—	—	—	1	1	1	1
1 to 5 years	—	—	—	—	—	—	1	—	—	—	1	—
5 to 10 „	—	—	2	—	—	—	—	—	1	—	3	—
10 to 15 „	2	—	—	—	—	—	—	—	—	—	2	—
15 to 20 „	1	—	—	—	—	—	—	—	—	—	1	—
20 to 30 „	1	—	1	—	—	—	—	—	—	—	2	—
30 to 40 „	2	1	—	—	—	—	—	—	—	—	2	1
40 to 50 „	—	—	1	—	—	—	—	—	—	—	1	—
50 to 60 ,	—	—	—	—	—	—	—	—	—	—	—	—
60 to 70 „	—	—	—	—	—	—	—	—	—	—	—	—
70 and over	—	—	—	—	—	—	—	—	—	—	—	—
Age not ascertained.	2	—	—	—	—	—	—	—	—	—	2	—
	8	1	4	—	—	—	1	—	2	1	15	2

In Chart XIX. the distribution of the various classes of vaccination and non-vaccination amongst the different types of small-pox is illustrated, first, on the whole number of cases as previously given, and next at each of the four age-periods employed in this report. It may assist in the comprehension of this chart if there be given here, in tabular form the statistical data upon which it has been constructed.

The following is a list of the unvaccinated persons who had the disease in its mildest form:—

TABLE CXI.

Cases of Mild Type in Unvaccinated Subjects.

Reference to Register.	Name.	Sex.	Age.	Onset.	Rash.	Date of Discharge from Hospital as Convalescent.	Remarks.
Batley, 192	A. A. N.	F.	5	Jan. 21	Jan. 22	Jan. 31	
„ 280	E. A. T.	F.	16	Feb. 2	Feb. 5	Feb. 12	
„ 402	L. P.	F.	7	March 3	March 6	March 19	
„ 481	E. B.	F.	61	April 2	April 7	April 12	Had small-pox in infancy.
„ 528	G. W.	F.	6	April 29	May 1	May 30	
„ 545	J. E. N.	M.	4	May 29	May 31	June 16	
Dewsbury, 109	T. W. C.	M.	27	March 7	March 10	March 31	
„ 203	H. T.	F.	43	May 11	May 14	May 28	
Heckmondwike, 13	A. N.	M.	1	Feb. 26	Feb. 28	?	Unsuccessful attempts at vaccination two weeks before onset of small-pox.
Morley, 18	H. B.	F.	2	June 18	June 21	July 18	
„ 19	J. E. B.	M.	7 mos.	June 18	June 21	?	
„ 31	E. T.	F.	4	July 18	July 18	?	
Soothill Upper, 27	A. D.	F.	7	May 16	May 17	June 6	

Thus one of the three unvaccinated adults who had a mild attack had previously suffered from small-pox.

Vaccination
nd small-
ox.

At Ages under 10 Years.

Type.	Vaccinated.		No Information on Vaccination.		Alleged Vaccination.		"Under" Vaccination.		Unvaccinated.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Confluent	1	—	—	—	1	—	7	3	87	50
Coherent	—	—	—	—	—	—	2	—	24	—
Discrete	9	1	1	—	—	—	—	—	35	2
Mild	34	—	1	—	—	—	7	—	9	—
Type not determined	—	—	2	—	—	—	1	—	2	1
Total	44	1	4	—	1	—	17	3	157	53

At Ages 10 to 30 Years.

Type.	Vaccinated.		No Information on Vaccination.		Alleged Vaccination.		"Under" Vaccination.		Unvaccinated.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Confluent	17	5	1	—	5	1	1	—	106	27
Coherent	38	—	—	—	3	—	1	—	33	—
Discrete	162	—	—	—	6	—	1	—	25	—
Mild	150	—	1	—	3	—	1	—	2	—
Type not determined	4	—	1	—	—	—	—	—	—	—
Total	371	5	3	—	17	1	4	—	166	27

At Ages 30 Years and upwards.

Type.	Vaccinated.		No Information on Vaccination.		Alleged Vaccination.		"Under" Vaccination.		Unvaccinated.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Confluent	26	9	—	—	3	1	—	—	17	9
Coherent	20	—	1	—	1	—	—	—	1	—
Discrete	88	—	1	—	2	—	—	—	2	—
Mild	70	—	—	—	1	—	—	—	2	—
Type not determined	2	1	1	—	—	—	—	—	—	—
Total	206	10	3	—	7	1	—	—	22	9

At Ages not ascertained.

Type.	Vaccinated.		No Information on Vaccination.		Alleged Vaccination.		"Under" Vaccination.		Unvaccinated.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Confluent	—	—	—	—	—	—	—	—	1	—
Coherent	1	—	—	—	—	—	—	—	—	—
Discrete	1	—	—	—	—	—	—	—	—	—
Mild	2	—	—	—	—	—	—	—	—	—
Type not determined	2	—	--	--	—	—	—	—	—	—
Total	6	—	—	—	—	—	—	—	1	—

Lastly, I append a table giving an analysis of all the vaccinated subjects at different age periods with respect to the number and quality of the vaccination marks and the type of attack from which they suffered.

Explanation of Chart XIX.:—

This chart is intended to embody all the facts gathered in the inquiry respecting the distribution of the various types of small-pox in the several classes of vaccination-relations.

The first series shows the actual numbers and the mortality of patients at all ages grouped in the series of "confluent," "coherent," "discrete," "mild," and in that where the type was "not ascertained," the condition as to vaccination being indicated as in other charts by means of different colours.

Below this series are four others, viz., at each age-period—"under 10 *years,"* "10 *to* 30 *years,"* "30 *years and over," and the few cases at which the age was not ascertained.*

The confluent *group contains* 273 *cases* (105 *deaths) at all ages*—96 (53 *deaths) under* 10 *years,* 130 (33 *deaths) at* 10 *to* 30, 46 (19 *deaths) at* 30 *upwards, and one at doubtful age.*

The coherent *group contains* 125 *cases (no deaths) at all ages*—26 *under* 10 *years,* 75 *at* 10 *to* 30, 23 *at* 30 *upwards, and one at doubtful age.*

The discrete *group contains* 333 *cases* (3 *deaths) at all ages*—45 (3 *deaths) at under* 10 *years,* 194 *at* 10 *to* 30, 93 *at* 30 *upwards, and one at doubtful age.*

The mild *group contains* 283 *cases (no deaths) at all ages*—51 *at under* 10 *years,* 157 *at* 10 *to* 30, 70 *at* 30 *upwards, and* 2 *at doubtful age.*

The uncertain *group contains* 15 *cases* (2 *deaths) at all ages*—3 *at under* 10 (1 *death*), 5 *at* 10 *to* 30, 3 (1 *death*) *at* 30 *upwards, and* 4 *at doubtful age.*

Table CXIII.

Cases with Primary Vaccination Cicatrix or Cicatrices Present.

Area of Cicatrix or Cicatrices.

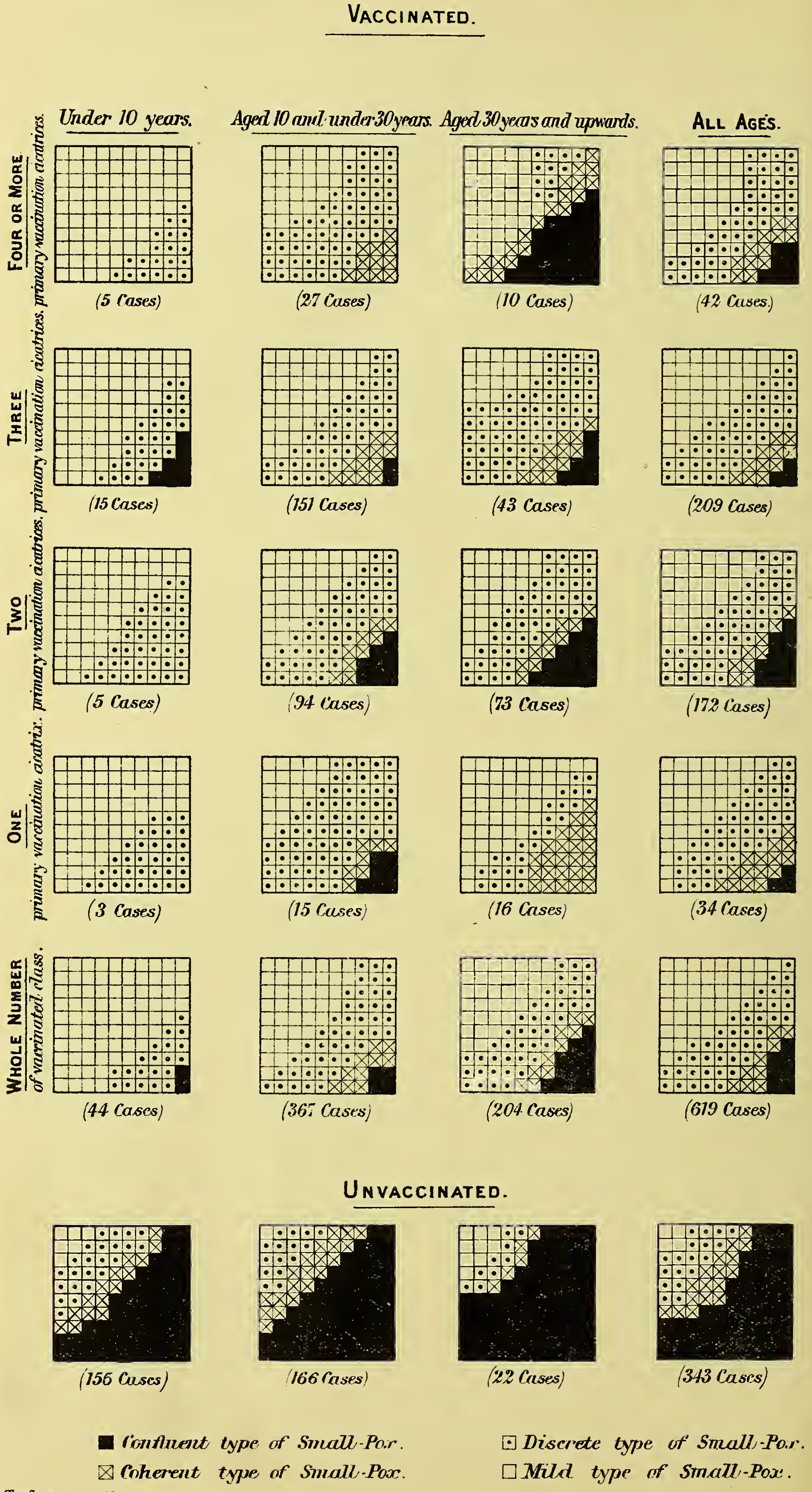
—	Class A^1= Half and upwards One-half Square Inch Total Area.																			
	Number of Scars.																			
	Four or more.				Three.				Two.				One.				Not recorded.			
	Foveation of Scars.																			
	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.
Under 10 years:																				
Confluent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Discrete	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—
Mild	2	—	1	—	6	—	4	—	1	—	—	—	—	—	—	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10 to 30 years:																				
Confluent	—	—	—	—	—	—	1	—	1	1	—	1	—	—	—	—	—	—	—	—
Coherent	1	—	—	—	5	2	2	—	4	—	—	—	1	—	—	—	—	—	—	1
Discrete	8	1	—	—	25	6	5	1	15	3	4	1	2	—	—	1	—	—	—	1
Mild	5	—	—	—	29	6	3	3	16	—	3	4	1	—	—	—	—	—	1	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30 years and upwards:																				
Confluent	1	—	—	—	—	—	—	—	1	2	—	2	—	—	—	—	—	—	—	1
Coherent	1	—	—	—	—	1	1	—	—	1	1	—	1	—	—	—	—	—	—	—
Discrete	—	—	1	—	5	2	4	1	10	1	4	—	2	—	—	—	—	—	—	—
Mild	3	1	—	—	3	—	2	—	11	—	1	—	2	—	—	1	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Age not ascertained:																				
Confluent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Discrete	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mild	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
At all ages:																				
Confluent	1	—	—	—	—	—	1	—	2	3	—	3	—	—	—	—	—	—	—	1
Coherent	2	—	—	—	5	3		—	4	1	1	—	2	—	—	—	—	—	—	1
Discrete	8	1	1	—	30	8	10	2	25	4	8	1	4	—	—	1	—	—	—	1
Mild	10	1	1	—	33	6	9	3	28	—	4	4	3	—	—	1	—	—	1	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	21	2	2	—	73	17	23	5	59	8	13	8	9	—	—	2	—	—	1	3
	25				118				88				11				4			
	246																			

—	Class A^2= One-third, but less than One-half Square Inch Total Area.																			
	Number of Scars.																			
	Four or more.				Three.				Two.				One.				Not recorded.			
	Foveation of Scars.																			
	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.
Under 10 years:																				
Confluent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Discrete	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mild	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10 to 30 years:																				
Confluent	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
Discrete	—	—	—	—	1	—	—	—	3	—	1	—	1	—	2	—	—	—	—	—
Mild	—	—	—	—	1	—	1	—	3	—	1	—	—	—	1	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30 years and upwards:																				
Confluent	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—	—	—
Discrete	—	—	—	—	—	—	1	—	—	1	1	—	1	—	—	—	—	—	—	—
Mild	—	—	—	—	—	—	—	—	2	—	—	—	1	—	—	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Age not ascertained:																				
Confluent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Discrete	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mild	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
At all ages:																				
Confluent	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	2	—	—	—	—	—	1	—	—	—	—	—
Discrete	—	—	—	—	1	—	1	—	3	1	2	—	2	—	2	—	—	—	—	—
Mild	—	—	—	—	1	—	1	—	5	—	1	—	1	—	1	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	2	—	2	—	12	1	3	—	3	—	4	—	—	—	—	—
	—				4				16				7				—			
	27																			

—	Class A^3= less than One-third Square Inch Total Area.																			
	Number of Scars.																			
	Four or more.				Three.				Two.				One.				Not recorded.			
	Foveation of Scars.																			
	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.
Under 10 years:																				
Confluent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Discrete	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—
Mild	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10 to 30 years:																				
Confluent	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Discrete	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—
Mild	—	—	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
30 years and upwards:																				
Confluent	—	—	—	—	—	—	1	—	—	—	2	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Discrete	—	—	—	—	—	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—
Mild	—	—	—	—	—	—	—	—	—	—	1	—	3	—	1	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Age not ascertained:																				
Confluent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Discrete	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Mild	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
At all ages:																				
Confluent	—	—	—	—	—	—	1	—	—	—	3	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—
Discrete	—	—	—	—	—	—	—	—	1	—	1	—	—	—	2	—	—	—	—	—
Mild	—	—	—	—	—	—	—	—	2	—	1	—	4	—	1	—	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	—	—	—	—	—	—	1	—	3	—	5	—	5	—	3	—	—	—	—	—
	—				1				8				8				—			
	17																			

—	Class A^4= Areas not recorded.																				Total Vaccinated Cases.	Deaths amongst Vaccinated Cases.			
	Number of Scars.																								
	Four or more.				Three.				Two.				One.				Not recorded.								
	Foveation of Scars.																								
	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.	Foveate.	Part (or Faint) Foveate.	Smooth and Faint Scars.	Not recorded.		Class A^1.	Class A^2.	Class A^3.	Class A^4.
Under 10 years:																									
Confluent	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Discrete	1	—	—	—	3	—	—	—	—	—	1	1	—	—	—	—	—	—	—	1	9	—	—	—	1
Mild	1	—	—	—	—	—	—	—	—	—	2	—	—	—	—	1	—	—	—	15	34	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
10 to 30 years:																									
Confluent	—	—	—	—	1	—	—	1	1	—	1	1	1	—	—	—	1	—	—	4	17	—	1	—	4
Coherent	2	—	—	—	6	—	—	3	1	—	—	2	—	—	—	—	—	—	—	7	38	—	—	—	—
Discrete	4	1	—	2	15	—	2	10	9	—	3	4	2	—	—	1	1	—	—	26	162	—	—	—	—
Mild	2	—	1	—	15	2	2	3	3	—	2	1	—	—	1	—	1	—	1	36	150	—	—	—	—
Type?	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	4	—	—	—	—
30 years and upwards:																									
Confluent	1	—	—	1	1	—	—	1	1	—	2	—	—	—	—	—	—	—	1	7	26	3	—	1	5
Coherent	—	—	—	1	2	—	—	1	1	—	1	2	1	—	—	—	1	—	—	1	20	—	—	—	—
Discrete	—	—	—	—	9	—	2	2	3	1	6	6	—	—	—	—	3	—	1	19	83	—	—	—	—
Mild	—	—	—	—	3	—	1	—	3	—	2	1	—	—	—	—	5	—	—	23	70	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1	2	—	—	—	1
Age not ascertained:																									
Confluent	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Coherent	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—
Discrete	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	—	—	—	—	—	1	—	—	—	—
Mild	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—
Type?	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—
At all ages:																									
Confluent	1	—	—	1	3	—	—	2	2	—	3	1	1	—	—	—	1	—	1	11	44	3	1	1	9
Coherent	2	—	—	1	3	—	—	4	3	—	1	4	1	—	—	—	1	—	—	8	59	—	—	—	—
Discrete	5	1	—	2	27	—	4	12	12	1	10	11	2	—	1	1	4	—	1	46	260	—	—	—	1
Mild	3	—	1	—	18	2	3	3	6	—	6	2	—	—	1	1	6	—	1	76	256	—	—	—	—
Type?	—	—	—	—	1	—	—	—	—	—	—	1	—	—	—	—	—	—	—	6	8	—	—	—	1
	11	1	1	4	57	2	7	21	23	1	20	19	4	—	2	2	12	—	3	147					
	17				87				63				8				162								
	337																				627	16			

CHART XX. — DIAGRAM SHOWING THE PROPORTION OF CASES OF SMALL-POX OF DIFFERENT TYPES WHICH OCCURRED IN VACCINATED AND UNVACCINATED PERSONS AT ALL AND CERTAIN SPECIFIED AGES.



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It may be of interest to analyse this Table (CXIII.) in the same manner as the age-incidence of the disease amongst the vaccinated has been treated, in order to ascertain whether these figures (small though they be) show any influence upon the type of small-pox examined by the area, number, or character of primary vaccination marks, *i.e.*, whether the severity of attacks is in any way related to the evidence of good or indifferent primary vaccination that are borne by the patients.

A. *Area of Vaccination Cicatrices in Relation to Type of Small-pox* :—

The area of the marks of vaccination was estimated in 290 cases, of which there were—

Confluent -	-	- 17 or 5 per cent.*
Coherent -	-	- 26 „ 9 „
Discrete -	-	- 120 „ 41 „
Mild -	-	- 127 „ 44 „

and employing the classification above given there were—

—	Class A¹.	Class A².	Class A³.	Area not recorded, Class A⁴.	Total.
Confluent	11 or 5 p.c.	2 or 8 p.c.	4 or 24 p.c.	27	44
Coherent -	22 „ 9 „	3 „ 11 „	1 „ 6 „	33	59
Discrete -	104 „ 42 „	12 „ 44 „	4 „ 24 „	140	260
Mild -	109 „ 44 „	10 „ 37 „	8 „ 47 „	129	256
	246	27	17	329	619
Type ? -	—	—	—	8	8
				337	627

The only notable feature of these statistics being the rise in the proportion of confluent cases with the diminution in area of marks.

Distributing the cases in age-periods there were :—

At ages under 10 *years* (17 cases).

—	Class A¹.	Class A².	Class A³.
Confluent -	—	—	—
Coherent -	—	—	—
Discrete -	1 or 7 per cent.	—	1 or 50 per cent.
Mild -	14 „ 93 „	—	1 „ 50 „
Total -	15	—	2

At ages 10 *to* 30 *years* (185 cases).

—	Class A¹.	Class A².	Class A³.
Confluent -	4 or 3 p.c.	1 or 6 p.c.	1 or 25 p.c.
Coherent -	16 „ 10 „	1 „ 6 „	—
Discrete -	73 „ 44 „	8 „ 47 „	1 or 25 p.c.
Mild -	71 „ 43 „	7 „ 41 „	2 „ 50 „
Total -	164	17	4

At ages 30 *years and over* (88 cases).

—	Class A¹.	Class A².	Class A³.
Confluent -	7 or 10 p.c.	1 or 10 p.c.	3 or 27 p.c.
Coherent -	6 „ 9 „	2 „ 20 „	1 „ 9 „
Discrete -	30 „ 45 „	4 „ 40 „	2 „ 18 „
Mild -	24 „ 36 „	3 „ 30 „	5 „ 46 „
Total -	67	10	11

Vaccination and small-pox

Again, the only striking fact is that at each age-period the most severe cases were more numerous in those classes in which the area of the vaccination marks was smallest.

B. *Number of Vaccination Cicatrices in Relation to Type of Small-pox* :—

Excluding from the whole number of the vaccinated those cases of which there is no record as to the number of marks, and also those of which the type of attack was not recorded, there remain 457 cases, of which there were—

Confluent	-	- 30 or 6·5 per cent.
Coherent -	-	- 48 „ 10·5 „
Discrete -	-	- 207 „ 45 „
Mild -	-	- 172 „ 38 „

and distributed according to the number of primary cicatrices—

—	Primary Vaccination Cicatrices.				No. of Marks not recorded.	Total.
	Four or more.	Three	Two.	One.		
Confluent	3 or 7 p.c.	7 or 4 p.c.	19 or 11 p.c.	1 or 3 p.c.	14	44
Coherent -	5 „ 12 „	23 „ 1 „	15 „ 9 „	5 „ 15 „	11	58
Discrete -	18 „ 43 „	95 „ 45 „	79 „ 46 „	15 „ 44 „	53	260
Mild -	16 „ 38 „	84 „ 40 „	59 „ 34 „	13 „ 38 „	84	256
	42	209	172	34	162	619
Type ? -	—	1	1		8	38
						627

It will be seen from these figures that as regards confluent attacks those having one mark only suffered the least, those having three marks had the next largest proportion of such attacks, those having four marks the next, and those having two marks yielded the greatest proportion of such cases. In the coherent series those having two marks yielded the lowest proportion, and those having one mark the highest, whilst the discrete and mild cases were fairly equally distributed throughout the classes.

As regards age-distribution there were :—

At ages under 10 *years* (44 cases).

—	Primary Vaccination Cicatrices.				All Classes, including not recorded Marks.
	Four or more.	Three.	Two.	One	
Confluent	—	1 or 7 p.c.	—	—	1 or 2 p.c.
Coherent	—	—	—	—	—
Discrete	1 or 20 p.c.	4 or 27 p.c.	2 or 40 p.c.	1 or 33 p.c.	9 or 20 p.c.
Mild -	4 „ 80 „	10 „ 66 „	3 „ 60 „	2 „ 67 „	34 „ 78 „
Total -	5	15	5	3	44

There were no confluent or coherent attacks with one exception—a child who had three marks—and of the rest it will be seen that the proportion of mild to discrete attacks was mostly higher in those having the larger number of cicatrices.

At ages 10 *years and under* 30 (367 cases).

—	Primary Vaccination Cicatrices				All Classes, including those in which Number of Marks not recorded.
	Four or more.	Three.	Two.	One.	
Confluent	—	3 or 2 p.c.	8 or 9 p.c.	1 or 7 p.c.	17 or 4 p.c.
Coherent	3 or 11 p.c.	18 „ 12 „	8 „ 9 „	1 „ 7 „	38 „ 10 „
Discrete	16 „ 59 „	65 „ 43 „	43 „ 46 „	10 „ 67 „	162 „ 45 „
Mild -	8 „ 30 „	65 „ 43 „	35 „ 36 „	3 „ 20 „	150 „ 41 „
Total -	27	151	94	15	367

---

* In all these calculations the per-centage is stated in whole numbers.

Vaccination and small-pox.

Thus there were no confluent attacks amongst those having four or more marks, and a much smaller proportion of such attacks amongst those with three marks than those with two or one, although the latter group had fewer than the former. Coherent attacks were more numerous in those with three or four marks than in those with one or two. There were fewest mild attacks in those who only had one mark, and most mild attacks in those with three marks.

At ages 30 *years and upwards* (204 cases). Marks were recorded in 142 :—

—	Primary Vaccination Cicatrices.				All Classes, inclusive of "non-recorded" marks.
	Four or more.	Three.	Two.	One.	
Confluent	3 or 30 p.c.	3 or 7 p.c.	11 or 15 p.c.	—	26 or 13 p.c.
Coherent	2 „ 20 „	5 „ 12 „	7 „ 10 „	4 or 25 p.c.	20 „ 10 „
Discrete	1 „ 10 „	26 „ 61 „	34 „ 46 „	4 „ 25 „	88 „ 43 „
Mild -	4 „ 40 „	9 „ 20 „	21 „ 29 „	8 „ 50 „	70 „ 34 „
Total -	10	43	73	16	204

The most striking fact at this age-period is the relatively large proportion of severe attacks amongst those having the largest number of vaccination marks. (*See* Chart XX.)

C.—*Foveation of Marks in Relation to Type of Small-pox.*

Of the 627 vaccinated subjects the character of marks as to foveation was noted in 417 cases, in one of which the type of disease was not recorded. The remainder comprise :—

Confluent - -	26 or	6 per cent.
Coherent - -	41 ,,	10 ,,
Discrete - -	183 ,,	44 ,,
Mild - - -	166 ,,	40 ,,

and distributed according as to whether the marks were (*a*) wholly foveated, (*b*) partly foveated, and (*c*) smooth or scarred. They were :—

—	Foveation of Primary Cicatrices.		
	Foveate.	Partly Foveate.	Smooth or Scarred.
Confluent - -	13 or 5 p.c.	3 or 10 p.c.	10 or 11 p.c.
Coherent - -	31 „ 11 „	4 „ 13 „	6 „ 7 „
Discrete - -	125 „ 42 „	15 „ 48 „	43 „ 47 „
Mild - - -	125 „ 42 „	9 „ 29 „	32 „ 35 „
Total -	294	31	91

Some slight concordance is thus seen to obtain amongst the confluent and mild series in respect to the degree of foveation and type of attack.

Again, subdividing these cases into age-periods there were—

At ages under 10 *years* (26 cases).

—	Vaccination Cicatrics.		
	Foveate.	Partly Foveate.	Smooth or Scarred.
Confluent - -	1 or 6 p.c.	—	—
Coherent - -	—	—	—
Discrete - -	4 or 25 p.c.	—	3 or 30 p.c.
Mild - - -	11 „ 69 „	—	7 „ 70 „
Total - -	16	—	10

Here, again, the exceptional occurrence of one confluent case gives a slight advantage to those with smooth marks over the foveate class; but it is noticeable (although the paucity of numbers does not warrant any sure conclusion) that there is otherwise no difference as to relative numbers of discrete and mild cases in each group.

At ages 10 *and under* 30 *years* (253 cases).

—	Primary Vaccination Cicatrices.		
	Foveate.	Partly Foveate.	Smooth or Scarred.
Confluent - -	6 or 3 p.c.	1 or 5 p.c.	3 or 7 p.c.
Coherent - -	21 „ 11 „	2 „ 9 „	2 „ 5 „
Discrete - -	88 „ 45 „	10 „ 48 „	17 „ 44 „
Mild - - -	78 „ 41 „	8 „ 38 „	17 „ 44 „
Total - -	194	21	39

Again, there is a slight increase in severity of attack amongst those with least foveated marks, a proportion reversed in the coherent series, and not evident in the other series.

At ages 30 *years and upwards* (135 cases).

—	Primary Vaccination Cicatrices.		
	Foveate.	Partly Foveate.	Smooth or Scarred.
Confluent - -	6 or 7 p.c.	2 or 20 p.c.	7 or 17 p.c.
Coherent - -	9 „ 11 „	2 „ 20 „	4 „ 10 „
Discrete - -	33 „ 39 „	5 „ 50 „	22 „ 54 „
Mild - - -	36 „ 43 „	1 „ 10 „	8 „ 19 „
Total - -	84	10	41

There were fewest confluent cases in these with foveate marks and most mild cases.

I must refer to the table for the figures in which the area, number, and character of marks are associated, but in conclusion may contrast the whole series of the vaccinated and unvaccinated (the type of whose attacks are known) in each of those age-periods :—

—	Under 10 Years.		10 to 30 Years.		30 Years and upwards.		All Ages.	
	Vaccinated.	Unvaccinated.	Vaccinated.	Unvaccinated.	Vaccinated.	Unvaccinated.	Vaccinated.	Unvaccinated.
Confluent -	1 or 2 p.c.	87 or 56 p.c.	17 or 4 p.c.	106 or 64 p.c.	26 or 13 p.c.	17 or 77 p.c.	44 or 7 p.c.	210 or 61 p.c.
Coherent -	—	24 „ 15 „	38 or 10 „	33 „ 20 „	20 „ 10 „	1 „ 5 „	58 „ 9 „	58 „ 17 „
Discrete -	9 or 20 p.c.	36 „ 23	162 „ 45 „	24 „ 15 „	88 „ 43 „	2 „ 9 „	259 „ 42 „	62 „ 18 „
Mild - -	34 „ 78 „	9 „ 6	150 „ 41 „	2 „ 1 „	70 „ 34 „	2 „ 9 „	254 „ 42 „	13 „ 4 „
Total -	44	156	367	165	204	22	615	343

The total number (627) of the vaccinated is made up by the addition of six whose ages were not ascertained, and six of which the type of attack is not recorded. These figures are given diagrammatically in Chart XX. (above).

Vaccination and small pox.

Utilising the above figures, it may be calculated that if (at all ages) the proportionate distribution between the 958 attacks were on the rate of the "vaccinated" (at all ages) and "unvaccinated" (at all ages) series respectively, the numbers would be—

—	At Vaccinated Rate (*for all ages*).	At Unvaccinated Rate (*for all ages*).	Actual Rate.
Confluent - - - - -	67	584	254
Coherent - - - - -	86	163	116
Discrete - - - - -	403	173	321
Mild - - - - - -	402	38	267
Total - - -	958	958	958

A similar, and in some instances even more striking, variation from the actual numbers would appear in each of the respective age-periods.

Thus at ages "under 10 years":—

—	At Vaccinated Rate (*for ages 0–10 years*).	At Unvaccinated Rate (*for ages 0–10 years*).	Actual Rate.
Confluent - - - - -	4	112	88
Coherent - - - - -	0	30	24
Discrete - - - - -	40	46	45
Mild - - - - - -	156	12	43
Total - - -	200	200	200

At ages "10 to 30 years":—

—	At Vaccinated Rate (*for ages 10–30 years*).	At Unvaccinated Rate (*for ages 10–30 years*).	Actual Rate.
Confluent - - - - -	21	340	123
Coherent - - - - -	53	106	71
Discrete - - - - -	240	80	186
Mild - - - - - -	218	6	152
Total - - -	532	532	532

At ages "30 years and upwards":—

—	At Vaccinated Rate (*for ages 30 years and over*).	At Unvaccinated Rate (*for ages 30 years and over*).	Actual Rate.
Confluent - - - - -	29	174	43
Coherent - - - - -	23	12	21
Discrete - - - - -	97	20	90
Mild - - - - - -	77	20	72
Total - - -	226	226	226

SIDNEY COUPLAND, M.D.

ADDENDUM.

Since writing the foregoing Report it has seemed to me that there is one question which has perhaps not received an adequate answer in any of the statistics that it contains. This question is whether there was any marked difference in the incidence of small-pox (1st) between households of different sizes, and (2nd) between the vaccinated and unvaccinated members of such households, in relation to the proportionate number of each class among these members.

I have therefore compiled, from the data already given such statistics that bear on these points, and have divided all the invaded houses into two groups, the one including those which contained six members or less, the other which contained more than six inmates. I have further calculated the relative proportion of the vaccinated and the unvaccinated in each group ; and, lastly, ascertained what has been the small-pox incidence upon the vaccinated and unvaccinated respectively.

1. Of 544 houses having 3,000 inmates, there were 887 attacked with small-pox, an incidence rate of 295 per 1,000.

2. Of these 3,000 persons, 2,271 were vaccinated, or 757 per 1,000 ; 527 were unvaccinated, or 175 per 1,000.

3. Of the *vaccinated* 544 were attacked with small-pox, an incidence rate of 239 per 1,000. Of the unvaccinated 294 were attacked with small-pox, an incidence rate of 557 per 1,000.

Houses with six inmates or less.

1. In 384 houses having 1,682 inmates, 554 were attacked with small-pox, an incidence rate of 329 per 1,000.

2. Of these 1,682 persons 1,247 were vaccinated, a proportion of 741 per 1,000 ; 314 were unvaccinated, a proportion of 186 per 1,000.

3. Of the vaccinated 344 were attacked with small-pox, an incidence rate of 275 per 1,000 ; of the unvaccinated 180 were attacked with small-pox, an incidence rate of 573 per 1,000.

Houses with more than six inmates.

1. In 160 houses having 1,318 inmates, 333 were attacked with small-pox, an incidence rate of 252 per 1,000.

2. Of these 1,318 persons 1,024 were vaccinated, a proportion of 769 per 1.000 ; 213 were unvaccinated, a proportion of 161 per 1,000.

3. Of the *vaccinated* 200 were attacked with small-pox, an incidence rate of 195 per 1,000. Of the *unvaccinated* 114 were attacked with small-pox, an incidence rate of 535 per 1,000.

It may be of interest to compare in each of the foregoing respects those households in which every one of those persons who were attacked with small-pox were *vaccinated*, with those in which every one who was attacked was *unvaccinated*, and also with those in which some were vaccinated and some unvaccinated. We have thus three groups :—

Group A.—Houses in which all the attacked were vaccinated. This group includes 324 houses.

Group B.—Houses in which all attacked were unvaccinated. This group includes 133 houses.

Group C.—Houses in which those attacked in each house were, some vaccinated, some unvaccinated. This group includes 87 houses.

GROUP A.

1. In 324 houses having 1,729 inmates, 441 were attacked with small-pox, an incidence rate of 255 per 1,000.

2. Of these 1,729 persons 1,513 were vaccinated, a proportion of 875 per 1,000 ; 104 were unvaccinated, a proportion of 60 per 1,000.

3. Of the *vaccinated* 409 were attacked with small-pox, an incidence rate of 270 per 1,000.

Houses with six inmates or less.

1. In 235 houses having 983 inmates, 297 were attacked, a proportion of 302 per 1,000.

2. Of these 983 persons 841 were vaccinated, a proportion of 855 per 1,000 ; 66 were vaccinated, a proportion of 67 per 1,000.

3. Of the *vaccinated* 273 were attacked with small-pox, an incidence rate of 324 per 1,000.

Houses with more than six inmates.

1. In 89 houses having 746 inmates, 144 were attacked with small-pox, an incidence rate of 193 per 1,000.

2. Of these 746 persons 672 were vaccinated, a proportion of 900 per 1,000, and 38 were unvaccinated, a proportion of 51 per 1,000.

3. Of the *vaccinated* 136 were attacked with small-pox, an incidence rate of 202 per 1,000.

GROUP B.

1. In 133 houses having 731 inmates, 168 were attacked with small-pox, an incidence rate of 229 per 1,000.

2. Of these 731 persons 421 were vaccinated, a proportion of 575 per 1,000 ; 261 were unvaccinated, a proportion of 357 per 1,000.

3. Of the *unvaccinated* 165 were attacked with small-pox, an incidence rate of 632 per 1,000.

Houses with six inmates or less.

1. In 99 houses having 459 inmates, 116 were attacked with small-pox, an incidence rate of 252 per 1,000.

2. Of these 459 persons 258 were vaccinated, a proportion of 562 per 1,000 ; 167 were unvaccinated, a proportion of 363 per 1,000.

3. Of the *unvaccinated* 115 were attacked with small-pox, an incidence rate of 688 per 1,000.

Houses with more than six inmates.

1. In 34 houses having 272 inmates, 52 were attacked with small-pox, an incidence rate of 191 per 1,000.

2. Of these 272 persons 123 were vaccinated, a proportion of 599 per 1,000 ; 94 were unvaccinated, a proportion of 345 per 1,000.

3. Of the *unvaccinated* 50 were attacked with small-pox, an incidence rate of 532 per 1,000.

GROUP C.

1. In 87 houses having 540 inmates, 278 were attacked with small-pox, an incidence rate of 514 per 1,000.

2. Of these 540 persons 337 were vaccinated, a proportion of 624 per 1,000 ; 16 were unvaccinated, a proportion of 300 per 1,000.

3. Of the vaccinated 135 were attacked with small-pox, an incidence rate of 40 per 1,000. Of the unvaccinated 129 were attacked, an incidence rate of 796 per 1,000.

Houses with six inmates or less.

1. In 50 houses with 240 inmates, 141 were attacked with small-pox, an incidence rate of 587 per 1,000.

2. Of these 240 persons 148 were vaccinated, a proportion of 616 per 1,000 ; 81 were unvaccinated, a proportion of 337 per 1,000.

3. Of the vaccinated 71 were attacked with small-pox, an incidence rate of 480 per 1,000. Of the unvaccinated 65 were attacked, an incidence rate of 802 per 1,000.

Houses with more than six inmates.

1. In 37 houses having 300 inmates, 137 were attacked with small-pox, an incidence rate of 456 per 1,000.

2. Of these 300 persons 189 were vaccinated, a proportion of 630 per 1,000 ; 81 were unvaccinated, a proportion of 270 per 1,000.

3. Of the *vaccinated* 64 were attacked with small-pox, an incidence rate of 338 per 1,000 ; of the *unvaccinated* 64 were attacked, an incidence rate of 790 per 1,000.

S. C.

VACCINATION COMMISSION.

APPENDIX IV.

TO THE

FINAL REPORT

OF THE

ROYAL COMMISSION ON VACCINATION.

REPORTS TO THE COMMISSION OF

DR. ARTHUR PEARSON LUFF

ON OUTBREAKS OF SMALL-POX IN LONDON IN 1892-3.

Presented to both Houses of Parliament by Command of Her Majesty.

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APPENDIX IV.

A.—Report of Dr. Arthur Pearson Luff on the Outbreak of Small-pox in London in 1892.

I beg to present my report of the outbreak of small-pox that occurred in London in 1892, with the various statistics that I have obtained as to the influence of vaccination on the number of cases attacked, the nature of the cases and the mortality, as well as the influence of the character and area of the vaccination marks on the disease. The outbreak commenced at the beginning of 1892, and practically concluded at the end of August of the same year. The cases notified as small-pox in London during this period were 352 in number. Of these the actual number of cases that proved to be small-pox were 292, the remaining 60 cases being in the majority of cases varicella.

The origin of the outbreak at the beginning of January 1892 was probably due to a case of small-pox imported into St. Pancras from Switzerland by a Swiss waiter, and from a Swiss waiters' club (the Helvetia Club, 107, Charlotte Street, Fitzroy Square), the disease spread to some of the members and servants of the club and through a member of the club to the French Hospital in Shaftesbury Avenue, from which source several cases were infected. In the latter part of February 1892 an outbreak of small-pox occurred in Shoreditch. The first case notified in Shoreditch was on February 29th, and was that of a boy resident in New Inn Street, who was probably infected by a girl taken ill about February 7th. Her case was not notified, and was supposed at the time to be a case of chicken-pox. A woman in the same house as this girl developed a mild attack of a similar disease about February 20th. The girl was probably infected by some person coming to her father's workshop, which was attached to the house, the person probably coming from an infected locality in search of work. About 90 cases in all were traceable to the case in New Inn Street. According to the report of Dr. Allan, at that time the Medical Officer of Health for Shoreditch, the 90 cases were distributed among 63 families residing in 47 houses, each containing two or more families, one of them being a crowded tenement house with 20 families

33 houses had 1 case each.
9 houses had 2 cases each.
1 house had 3 cases.
1 house had 5 cases.
2 houses had 6 cases each.
1 tenement house had 19 cases.

In all but three instances only one house in the street was infected. These three were—New Inn Street with 10 houses; Drysdale and Essex Streets with 2 each. In Rodney Buildings, where a large number of families lived, a great number of cases occurred, as will be seen by reference to the Forms "A." and "B." which I forward to the Commission with this report.* A number of cases were also probably infected through dirty linen from the French Hospital.

Owing to my not being appointed to inquire into the outbreak until June 18th, 1892, when the outbreak was subsiding, it was difficult to obtain full particulars of many of the cases, and in a few of the cases all inquiries proved futile. On the forms marked "A" will be found the particulars which show that the source of infection has been traced in the majority of cases, and fuller particulars of the individual cases will be found on the forms marked "B." After my being appointed to inquire into the outbreak on June 18th, I visited the fresh cases, and saw as many of them as I could gain access to. With regard to the cases notified previous to June 18th, I was able to see some of them at the hospital ships at Long Reach, Dartford, and some of them at their homes; and the particulars as to vaccination, nature and area of the vaccination marks, re-vaccination, &c. so obtained, have been supplemented by data kindly furnished me by Dr. Birdwood, the medical superintendent of the hospital ships at that time, by the Metropolitan Asylums Board, and by the Medical Officers of Health of the different districts, to all of whom I am indebted for much valuable information that has been at all times most courteously given. With regard to many of the cases that were treated at their homes, it was difficult to obtain much information, partly on account of the time that had elapsed and partly on account of the unwillingness of the friends to respond to the inquiries that were made. Of the 292 cases of small-pox that occurred, I have obtained the following particulars:—

Whether vaccinated, re-vaccinated or un-vaccinated, information was obtained in 279 cases.

No further information obtained beyond the fact of small-pox having been caught in 13 cases, mainly owing to the people having removed and my not being able to trace them; but from inquiries that I made, no instance of death occurring in these 13 cases was heard of.

Of the 279 cases, I ascertained that 63 cases (22·5 per cent. of the whole) occurred in children under 10 years of age.

Of the 279 cases that I was able to investigate, 39 were unvaccinated; and in 26 other cases, the vaccination was doubtful by reason of the absence of marks from the arms, no scars being visible. Deducting these 65 cases from the 279 cases attacked, 214 are left, representing those who had undoubtedly been vaccinated, and of these the following particulars were obtained:—

Information as to whether re-vaccinated or not was obtained in all cases.

Information as to the number of vaccination scars was obtained in 197 cases.

Information as to foveation or not of the scars was obtained in 197 cases.

Information as to the area of the vaccination scars was obtained in 135 cases.

The meanings attached to the terms "vaccinated class," "revaccinated class," and "unvaccinated class" in this report are those given in Dr. Barry's report on the Sheffield small-pox epidemic of 1887–1888.

"*Vaccinated class*" includes all persons successfully vaccinated at any period exceeding 13 days prior to the appearance on them of the eruption of small-pox.

"*Unvaccinated class*" includes all persons who have either never been successfully vaccinated or whose vaccination was performed for the first time within 13 days of the appearance on them of the eruption of small-pox.

"*Re-vaccinated class*," includes all persons successfully re-vaccinated at any period exceeding 13 days prior to the appearance on them of the eruption of small-pox.

Table I. gives—

(1.) The number of attacks at different age-periods.
(2.) The number of deaths that occurred.
(3.) The nature of attack and the number of deaths occurring with each variety of small-pox.
(4.) The influence of the number, and foveation of the vaccination scars, and of the area of the vaccination scars on (*a*) the nature of the attack, (*b*) the mortality.
(5.) The influence of re-vaccination on (*a*) the nature of the attack, (*b*) the mortality.
(6.) The number of those who were known to have been vaccinated, but in connection with whom the number and nature of the scars could not be ascertained.
(7.) The number of doubtful cases of vaccination, with the number of deaths and the nature of the attack.
(8.) The number of unvaccinated cases, with the number of deaths and the nature of the attack.

In all these groups special columns show the number of deaths that occurred in connection with each variety of small-pox.

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* *Not here reproduced.*

TABLE I.

Age Period.	All Cases.							VACCINAT																							
								Nature of Attack in reference to Numb																							
								One Scar.										Two Scars.										Thr			
	No.	Deaths.	Nature of Attack.					Foveated.					Unfoveated.					Foveated.					Unfoveated.					Foveated.			
								Nature of Attack.					Nature of Attack.					Nature of Attack.					Nature of Attack.					Nature of Attack			
			Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.
Under 1 year.	8	3	4	0	4	0	0 0 3 0	0	0	0	0	0 0 0 0	0	0	0	0	0 0 0 0	0	0	0	0	0 0 0 0	0	0	0	0	0 0 0 0	1	0	0	0
1 to 5 years.	20	8	7	4	8	1	0 0 7 1	0	0	0	0	0 0 0 0	0	0	0	0	0 0 0 0	0	0	0	0	0 0 0 0	0	0	0	0	0 0 0 0	0	0	0	0
5 to 10 years.	35	2	15	16	3	1	0 0 1 1	0	0	0	0	0 0 0 0	0	3	0	0	0 0 0 0	1	1	0	0	0 0 0 0	0	0	0	0	0 0 0 0	4	1	0	0
10 to 15 years.	41	0	16	19	6	0	0 0 0 0	0	0	1	0	0 0 0 0	2	1	1	0	0 0 0 0	1	1	0	0	0 0 0 0	0	0	0	0	0 0 0 0	4	4	0	0
15 to 20 years.	58	2	18	32	7	1	0 0 1 1	0	2	0	0	0 0 0 0	0	0	0	0	0 0 0 0	2	1	0	0	0 0 0 0	0	6	1	0	0 0 0 0	3	6	0	0
20 to 30 years.	67	3	9	45	10	3	0 0 0 3	0	4	0	0	0 0 0 0	1	0	1	0	0 0 0 0	0	5	0	0	0 0 0 0	0	2	1	1	0 0 0 1	3	9	1	0
30 to 40 years.	29	4	4	13	12	0	0 0 4 0	1	1	0	0	0 0 0 0	0	1	0	0	0 0 0 0	0	1	0	0	0 0 0 0	0	2	1	0	0 0 0 0	0	1	1	
40 years and over.	21	3	4	13	4	0	0 0 3 0	0	2	0	0	0 0 0 0	0	2	1	0	0 0 1 0	1	1	0	0	0 0 0 0	0	1	0	0	0 0 0 0	0	1	0	
Totals	279	25	77	142	54	6	0 0 19 6	1	9	1	0	0 0 0 0	3	7	3	0	0 0 1 0	5	10	0	0	0 0 0 0	0	11	3	1	0 0 0 1	15	22	2	

TABLE I.

haracter of Scars.															Nature of Attack in reference to Area of Scars.															Number of Scars unknown.				
Scars.				Four or more Scars.											Area under ¼ sq. Inch.					Area from ¼ to ½ sq. Inch.					Area over ½ sq. Inch.									
nfoveated.				Foveated.					Unfoveated.																								
ure of Attack.				Nature of Attack.					Nature of Attack.					Nature of Attack.					Nature of Attack.					Nature of Attack.					Nature of Attack.				
Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.
			0	1				0	2				0	0				0	0				0	1				0	0				0
0			0		0			0		0			0		0			0		0			0		0			0		0			0
	0		0			0		0			0		0			0		0			0		0			0		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0
			0	3				0	2				0	0				0	2				0	3				0	0				0
0			0		0			0		0			0		0			0		0			0		0			0		1			0
	0		0			0		0			0		0			0		0			0		0			0		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0
			0	2				0	3				0	0				0	3				0	2				0	5				0
3			0		1			0		1			0		1			0		3			0		2			0		2			0
	0		0			0		0			0		0			0		0			0		0			0		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0
			0	3				0	3				0	2				0	1				0	6				0	1				0
2			0		2			0		5			0		2			0		6			0		4			0		1			0
	0		0			0		0			0		0			1		0			1		0			0		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0
			0	4				0	7				0	0				0	3				0	8				0	0				0
2			0		6			0		3			0		4			0		6			0		10			0		2			0
	0		0			1		0			0		0			0		0			0		0			1		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0
			0	3				0	1				0	0				0	0				0	7				0	0				0
2			0		7			0		6			0		5			0		12			0		11			0		4			0
	1		0			1		0			1		0			2		0			0		0			2		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0
			0	0				0	2				0	1				0	1				0	1				0	0				0
1			0		1			0		4			0		2			0		4			0		1			0		0			0
	1		0			2		0			1		0			1		0			1		0			2		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0
			0	0				0	1				0	0				0	0				0	1				0	0				0
1			0		0			0		3			0		2			0		3			0		2			0		1			0
	0		0			0		0			1		1			1		1			1		1			0		0			0		0
		0	0				0	0				0	0				0	0				0	0					0				0	0
			0	16				0	21				0	3				0	10				0	29					6				0
11			0		17			0		22			0		16			0		34			0		30			0		11			0
	2		0			4		0			3		1			5		1			3		1			5		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0

TABLE I.—*continued.*

Age Period.	RE-VACCINATED													
	Re-vaccinated Once.							Re-vaccinated Twice.						
	No.	Deaths.	Nature of Attack.					No.	Deaths,	Nature of Attack.				
			Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.			Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.
Under 1 year - -	0	0	0				0	0	0	0				0
				0			0				0			0
					0		0					0		0
						0	0						0	0
1 to 5 years - - -	0	0	0				0	0	0	0				0
				0			0				0			0
					0		0					0		0
						0	0						0	0
5 to 10 years - -	0	0	0				0	0	0	0				0
				0			0				0			0
					0		0					0		0
						0	0						0	0
10 to 15 years - -	1	0	1				0	0	0	0				0
				0			0				0			0
					0		0					0		0
						0	0						0	0
15 to 20 years - -	1	0	1				0	0	0	0				0
				0			0				0			0
					0		0					0		0
						0	0						0	0
20 to 30 years - -	2	0	2				0	0	0	0				0
				0			0				0			0
					0		0					0		0
						0	0						0	0
30 to 40 years - -	3	0	1				0	0	0	0				0
				1			0				0			0
					1		0					0		0
						0	0						0	0
40 years and upwards -	2	1	0				0	2	0	2				0
				1			0				0			0
					1		1					0		0
						0	0						0	0
Totals - - -	9	1	5				0	2	0	2				0
				2			0				0			0
					2		1					0		0
						0	0						0	0

TABLE I.—*continued.*

SES.							Vaccination doubtful. No Scars visible.							Unvaccinated Cases.						
Re-vaccinated Three Times.																				
		Nature of Attack.							Nature of Attack.							Nature of Attack.				
No.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	No.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.	No.	Deaths.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Deaths.
0	0	0	0	0	0	0 0 0 0	0	0	0	0	0	0	0 0 0 0	4	3	0	0	4	0	0 0 3 0
0	0	0	0	0	0	0 0 0 0	1	0	0	0	1	0	0 0 0 0	11	8	0	3	7	1	0 0 7 1
0	0	0	0	0	0	0 0 0 0	0	0	0	0	0	0	0 0 0 0	8	2	0	4	3	1	0 0 1 1
0	0	0	0	0	0	0 0 0 0	1	0	0	1	0	0	0 0 0 0	6	0	0	2	4	0	0 0 0 0
0	0	0	0	0	0	0 0 0 0	8	2	1	4	2	1	0 0 1 1	4	0	0	1	3	0	0 0 0 0
0	0	0	0	0	0	0 0 0 0	6	1	0	5	0	1	0 0 0 1	6	1	0	1	4	1	0 0 0 1
0	0	0	0	0	0	0 0 0 0	7	4	0	1	6	0	0 0 4 0	0	0	0	0	0	0	0 0 0 0
0	0	0	0	0	0	0 0 0 0	3	1	0	1	2	0	0 0 1 0	0	0	0	0	0	0	0 0 0 0
0	0	0	0	0	0	0 0 0 0	26	8	1	12	11	2	0 0 6 2	39	14	0	11	25	3	0 0 11 3

Of the 39 cases occurring among unvaccinated persons, 14 proved fatal. Of the 26 cases occurring among persons whose vaccination was doubtful, eight proved fatal. Of the 214 cases occurring among vaccinated persons, three proved fatal.

These figures converted to per-centages give the following results :—

TABLE II.

Fatality as a Per-centage among the Vaccinated and Unvaccinated.

Per-centage of Deaths among the Vaccinated.	Per-centage of Deaths among those whose Vaccination was doubtful.	Per-centage of Deaths among the Unvaccinated.
1·4	30·7	35·9

A comparison of the fatality as a per-centage among the total sufferers, the vaccinated, those whose vaccination was doubtful, and the unvaccinated gives the following results :—

TABLE III.

—	No.	Deaths.	Per-centage of Deaths.
Total sufferers -	279	25	8·9
Vaccinated cases -	214	3	1·4
Doubtful cases -	26	8	30·7
Unvaccinated cases -	39	14	35·9

so that the mortality among the unvaccinated was 25 times that of the vaccinated cases.

Had the unvaccinated cases died at the rate of the vaccinated class, in place of the 14 deaths there would have been 0·5 death. Had the vaccinated cases died at the rate of the unvaccinated class, in place of the three deaths there would have been 76 deaths.*

With regard to the mortality at different ages among the vaccinated and unvaccinated cases (all reference to "doubtful" cases being here and henceforth omitted), the following summary is obtained :—

TABLE IV.

Age Incidence of Attack and Death from Small-pox among the Vaccinated and Unvaccinated, with Per-centages of Deaths to Attacks at different Ages.

Age Periods.	Vaccinated.			Unvaccinated.		
	Cases.	Deaths.	Per-centage of Deaths.	Cases.	Deaths.	Per-centage of Deaths.
0 to 1 year -	4	0	0·0	4	3	75·0
1 to 5 years -	8	0	0·0	11	8	72·7
5 to 10 years -	27	0	0·0	8	2	25·0
10 to 15 years -	34	0	0·0	6	0	0·0
15 to 20 years -	46	0	0·0	4	0	0·0
20 to 30 years -	55	1	1·8	6	1	16·6
30 to 40 years -	22	0	0·0	0	0	0·0
40 years and over -	18	2	11·1	0	0	0·0
Totals -	214	3	1·4	39	14	35·9

From this table it is seen that under 10 years of age no deaths occurred among the vaccinated, whereas among the unvaccinated under 10 years of age who caught small-pox, 56·5 per cent. of deaths occurred. Over 10 years of age the percentage of deaths among the vaccinated was 1·7, and among the unvaccinated, 6·2. The table also shows that vaccination gave absolute protection against death to the age of 20 years, whereas among the unvaccinated cases up to 20 years of age the fatality was 39 per cent.

Proceeding now to the consideration of the facts as to the nature or severity of the attack among the vaccinated and unvaccinated, the following are the results :—

TABLE V.

Nature of Attack.	Vaccinated.	Unvaccinated.
Very mild - - -	76	0
Discrete - - -	119	11
Confluent - - -	18	25
Hæmorrhagic - -	1	3
Totals - -	214	39

This table shows that 18 vaccinated persons out of 214 (8 per cent.) had confluent small-pox, whereas 25 unvaccinated persons out of 39 (64 per cent.) had confluent small-pox. Putting the confluent and hæmorrhagic cases together it is seen that 8·8 per cent. of the vaccinated had bad attacks, whilst 71·8 per cent. of the unvaccinated had bad attacks. The chances of a bad attack among the unvaccinated as compared with the vaccinated being 8 to 1. Moreover, out of the 18 cases of confluent small-pox occurring in vaccinated persons, only two deaths occurred ; whereas out of the 25 cases of confluent small-pox occurring in unvaccinated persons 11 deaths occurred. The single case of hæmorrhagic small-pox in a vaccinated person occurred in an individual between 20 and 30 years of age, who had been vaccinated in infancy only, and had two unfoveated scars.

If now the figures are taken as to the nature or severity of attack among the vaccinated and unvaccinated under 10 years of age, the following results are obtained :—

TABLE VI.

Cases under 10 Years of Age.

Nature of Attack.	Vaccinated.	Unvaccinated.
Very mild - - -	26	0
Discrete - - -	13	7
Confluent - - -	0	14
Hæmorrhagic - -	0	2

Under 10 years of age none of the vaccinated had bad attacks, whereas 69·5 per cent. of the unvaccinated had bad attacks.

With regard to the facts obtained as to the nature or severity of the attack and the per-centages of deaths among the vaccinated, re-vaccinated, and unvaccinated classes, the results are arranged in Table VII.

TABLE VII.

—	No. of Cases.	Nature of Attack.		No. of Deaths.	Per-centage of Deaths.
		Mild.	Severe.		
Vaccinated once -	203	186	17	2	0·9
Re-vaccinated -	11	9	2	1	9·0
Unvaccinated - -	39	11	28	14	35·9

---

* Had the cases of doubtful vaccination died at the rate of the vaccinated class, in place of the eight deaths there would have been 0·3 death ; had they died at the rate of the unvaccinated class, in place of the eight deaths there would have been nine deaths.

As regards the age incidence of the vaccinated persons attacked, the following are the particulars :—

TABLE VIII.

Age Incidence of Vaccinated Persons attacked.	
Under 10 Years.	Over 10 Years.
39	175

With regard to the re-vaccinated cases out of the 214 vaccinated cases, 11 had been re-vaccinated, and of these 11 re-vaccinated cases, nine had been re-vaccinated once, and two had been re-vaccinated twice. No person re-vaccinated a third time was attacked with small-pox.

With regard to the facts as to the nature of attack and mortality among the vaccinated, the 214 cases resolve themselves thus :—

TABLE IX.

Vaccinated Cases.

Nature of Attack.	No.	Deaths.
Very mild - - -	76	0
Discrete - - -	119	0
Confluent - - -	18	2
Hæmorrhagic - -	1	1

Setting out the facts in tabular fashion as to the nature of attack at different ages among the vaccinated, the following table is obtained :—

TABLE X.

Age Period.	Nature of Attack.				Per-centage of Cases.			
	Very mild.	Discrete.	Confluent.	Hæmorrhagic.	Very mild.	Discrete.	Confluent.	Hæmorrhagic.
0 to 1 year - -	4	0	0	0	100·0	0·0	0·0	0·0
1 to 5 years - -	7	1	0	0	87·5	12·5	0·0	0·0
5 to 10 years -	15	12	0	0	55·5	44·5	0·0	0·0
10 to 15 years -	16	16	2	0	47·0	47·0	6·0	0·0
15 to 20 years -	17	27	2	0	36·9	58·7	4·4	0·0
20 to 30 years -	9	39	6	1	16·3	70·9	11·0	1·8
30 to 40 years -	4	12	6	0	18·2	54·5	27·3	0·0
40 years and over -	4	12	2	0	22·2	66·7	11·1	0·0

From this table it is seen that up to 10 years of age small-pox in vaccinated persons was of a mild nature and that from 10 to 20 years of age it only appeared in a severe form among the vaccinated in a small proportion of the cases; whereas after 20 years of age the proportion of the severe cases is much greater.

The data obtained showing the relation existing between the number of vaccination scars and the nature of attack give when tabulated the following results :—

TABLE XI.

Age Periods.	One Scar.		Two Scars.		ThreeScars.		Four Scars.	
	Discrete.	Confluent.	Discrete.	Confluent.	Discrete.	Confluent.	Discrete.	Confluent.
0 to 1 year - -	0	0	0	0	1	0	3	0
1 to 5 years -	0	0	0	0	2	0	5	0
5 to 10 years -	3	0	2	0	8	0	7	0
10 to 15 years -	3	2	2	0	12	0	13	0
15 to 20 years -	2	0	9	1	11	0	20	1
20 to 30 years -	5	1	7	2	15	2	17	2
30 to 40 years -	3	0	3	1	3	2	7	3
40 years and over -	4	1	3	0	4	0	4	1
Totals - -	20	4	26	4	56	4	76	7

From this table the following relative particulars of discrete and confluent attacks as compared with the number of vaccination scars can be deduced.

For all Ages.

1 *scar.*—5 cases of discrete to 1 case of confluent.
2 *scars.*—6·5 ,, ,, 1 ,, ,,
3 *scars.*—14 ,, ,, 1 ,, ,,
4 *scars.*—11 ,, ,, 1 ,, ,,

Under 20 Years of Age.

1 *scar.*—4 cases of discrete to 1 case of confluent.
2 *scars.*—13 ,, ,, 1 ,, ,,
3 *scars.*—34 ,, ,, 0 ,, ,,
4 *scars.*—48 ,, ,, 1 ,, ,,

These results fairly bear out the conclusion that the greater the number of vaccination scars, the less severe is the nature of the attack.

Taking next into consideration the influence of foveated and unfoveated scars upon the nature of attack, the following are the results obtained :—

TABLE XII.

Age Periods.	One Scar.				Two Scars.				Three Scars.				Four Scars.			
	Foveated.		Unfoveated.		Foveated.		Unfoveated.		Foveated.		Unfoveated.		Foveated.		Unfoveated.	
	Discrete.	Confluent.	Discrete.	Confluent.	Discrete.	Confluent.	Discrete.	Confluent.	Discrete.	Confluent.	Discrete.	Confluent.	Discrete.	Confluent.	Discrete.	Confluent.
0 to 1 year - - -	0	0	0	0	0	0	0	0	1	0	0	0	1	0	2	0
1 to 5 years - - -	0	0	0	0	0	0	0	0	0	0	2	0	3	0	2	0
5 to 10 years - -	0	0	3	0	2	0	0	0	5	0	3	0	3	0	4	0
10 to 15 years - -	0	1	3	1	2	0	0	0	8	0	4	0	5	0	8	0
15 to 20 years - -	2	0	0	0	3	0	6	1	9	0	2	0	10	1	10	0
20 to 30 years - -	4	0	1	1	5	0	2	2	12	1	3	1	10	1	7	1
30 to 40 years - -	2	0	1	0	1	0	2	1	1	1	2	1	1	2	6	1
40 years and over - -	2	0	2	1	2	0	1	0	1	0	3	0	0	0	4	1
Total cases - -	10	1	10	3	15	0	11	4	37	2	19	2	33	4	43	3

Reducing these to per-centages of confluent attacks among those of all ages having foveated or unfoveated vaccination scars, the results are as follows :—

TABLE XIII.

All Ages.

—	One Scar.		Two Scars.		Three Scars.		Four Scars.	
	Foveated.	Unfoveated.	Foveated.	Unfoveated.	Foveated.	Unfoveated.	Foveated.	Unfoveated.
Per-centages of confluent attacks.	9	23	0	26	5	9	10	7

With the exception of the per-centages obtained in connexion with the cases of four scars, more confluent attacks occur in those having unfoveated scars than in those having foveated. This becomes more apparent if the figures are lumped together under each of the sub-headings, when the following results are obtained :—

TABLE XIV.

No. of Scars.	Foveated.		Unfoveated.	
	Discrete.	Con-fluent.	Discrete.	Con-fluent.
One scar - -	10	1	10	3
Two scars - -	15	0	11	4
Three scars - -	37	2	19	2
Four scars - -	33	4	43	3
Total cases -	95	7	83	12
Per-centages -	93·2	6·8	87·4	12·6

This table shows that 6·8 per cent. of confluent attacks occurred amongst those having foveated scars, whereas 12·6 per cent. of confluent attacks occurred among those having unfoveated scars, showing that the proportion of cases of confluent small-pox occurred in the latter class was nearly double that of the former.

By looking to the death-rates the results bear out a similar conclusion.

TABLE XV.

—	Foveated.			Unfoveated.		
	Cases.	Deaths.	Mortality Per Cent.	Cases.	Deaths.	Mortality Per Cent.
One scar - -	11	0	0·0	13	1	7·7
Two scars - -	15	0	0·0	15	1	6·6
Three scars - -	39	0	0·0	21	0	0·0
Four scars - -	37	0	0·0	46	1	2·1
Totals - -	102	0	0·0	95	3	3·1

These results indicate that foveation of cicatrices is superior in protecting against death as compared with the protecting power of unfoveated scars.

Taking, lastly, into consideration the influence of the combined area of the vaccination scars of the individuals attacked, upon the nature of attack, the following are the results :—

TABLE XVI.

Age Periods.	Area of Scar under ·25 sq. in.		Area of Scar from ·25 to ·5 sq. in.		Area of Scar over ·5 sq. in.	
	Dis-crete.	Con-fluent.	Dis-crete.	Con-fluent.	Dis-crete.	Con-fluent.
0 to 1 year - -	0	0	0	0	1	0
1 to 5 years -	0	0	2	0	3	0
5 to 10 years -	1	0	6	0	4	0
10 to 15 years -	4	1	7	1	10	0
15 to 20 years -	4	0	9	0	18	1
20 to 30 years -	5	2	12	0	18	2
30 to 40 years -	3	1	5	1	2	2
40 years and over -	2	1	3	1	3	0
Totals - -	19	5	44	3	59	5

If these figures are worked out so as to show the per-centages of confluent attacks at all ages when the area of the vaccination scars is respectively under ·25 sq. in., from ·25 to ·5 sq. in., and over ·5 sq. in., the following table is obtained :—

TABLE XVII.

All Ages.

—	Area of Scars under 0·25 sq. in.	Area of Scars from 0·25 to 0·5 sq. in.	Area of Scars over 0·5 sq. in.
Per-centages of confluent attacks.	21	6	7

or if the figures are worked so as to show the per-centages of very mild attacks at all ages when the area of the vaccination scars is respectively under ·25 sq. in., from ·25 to ·5 sq. in., and over ·5 sq. in., the following table is obtained :—

TABLE XVIII.

All Ages.

—	Area of Scars under 0·25 sq. in.	Area of Scars from 0·25 to 0·5 sq. in.	Area of Scars over 0·5 sq. in.
Per-centages of very mild attacks.	12	21	45

Reducing these to proportions of discrete to confluent attacks, the results are as follows :—

TABLE XIX.

Area of Scars.	Proportion of Discrete to Confluent Cases.
Area of scar under ·25 sq. in.	4 discrete cases to 1 confluent.
Area of scar from ·25 to ·5 sq. in.	15 „ „ 1 „
Area of scar over ·5 sq. in. -	12 „ „ 1 „

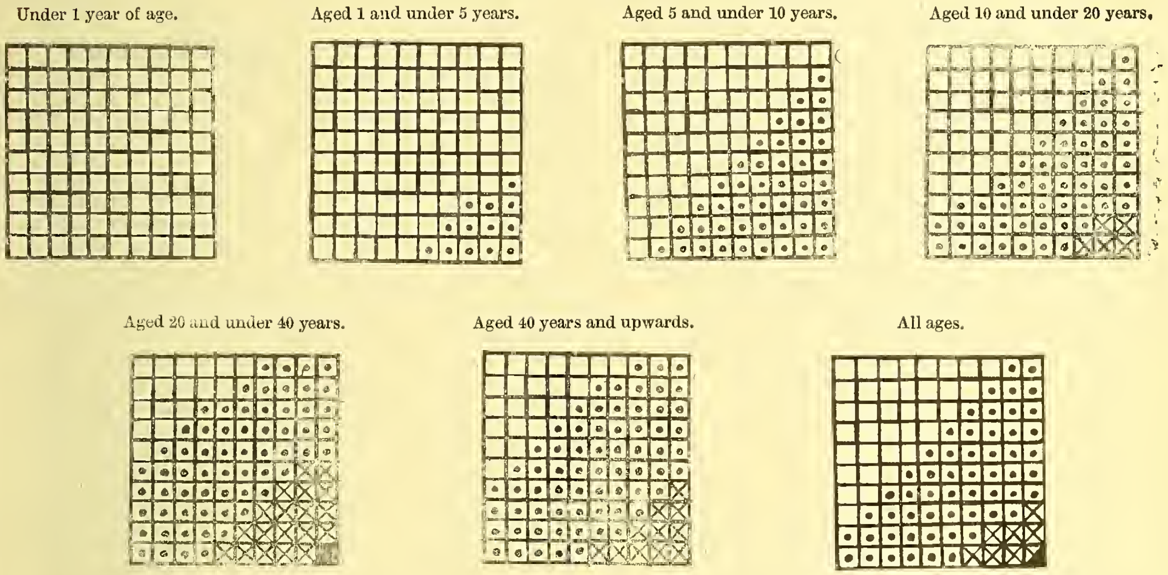
By looking to the death rates the results are even more striking. These results show that the greater the combined area of the vaccination scars, the greater is the protection against death, and that in the cases in which the combined area was over 0·5 sq. in. no death occurred.

TABLE XX.

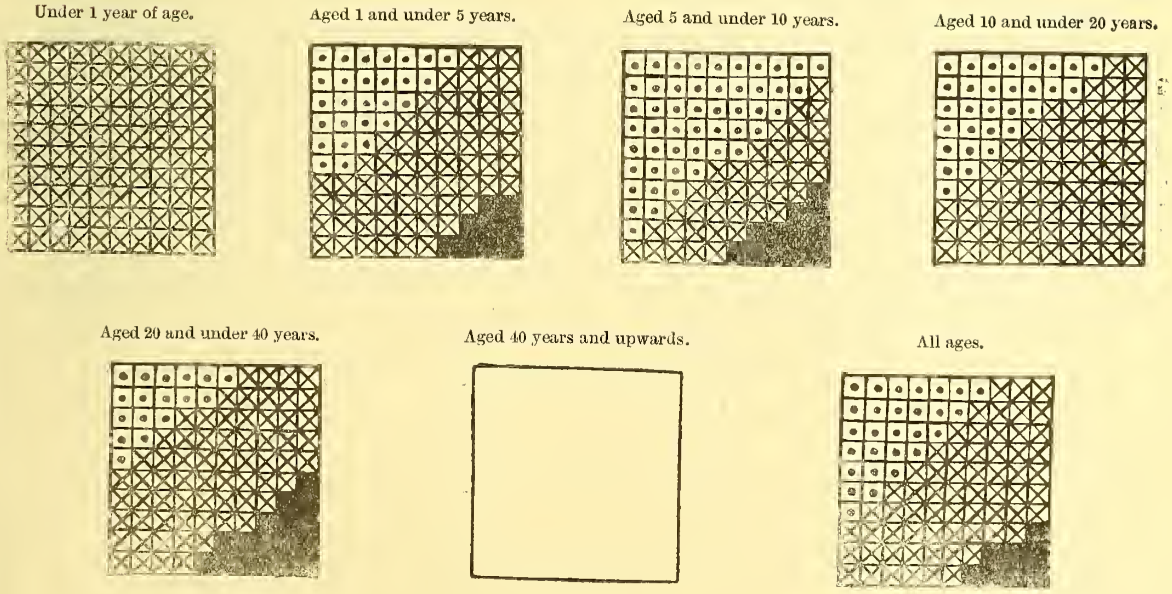
Area of Scars.	Cases.	Deaths.	Mortality per Cent.
Area of scar under ·25 sq. in.	24	1	4·1
Area of scar from ·25 to ·5 sq. in.	47	1	2·1
Area of scar over ·5 sq. in.	64	0	0·0

Diagram showing the Proportion of Cases of Small-pox of different Types which occurred in Persons of the "Vaccinated" and "Unvaccinated" Classes respectively at all and certain specified Ages in the London Small-pox Outbreak of 1892.

Vaccinated Class.

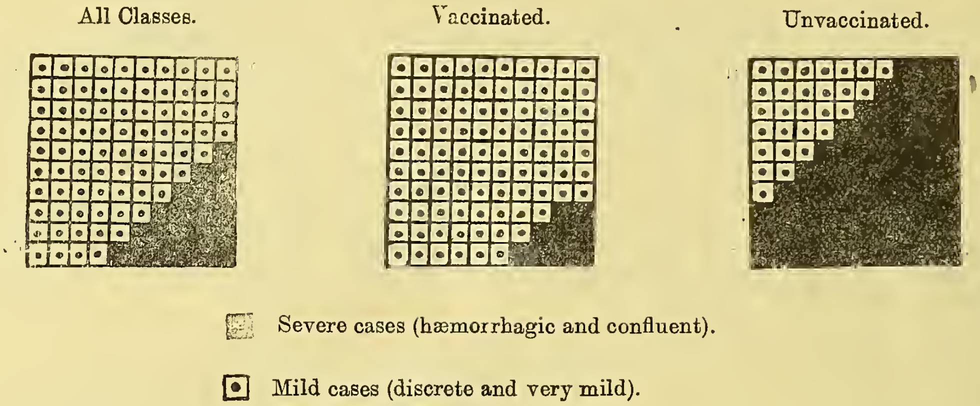


Unvaccinated Class.



▨ Hæmorrhagic. ☒ Confluent. ⊡ Discrete. ☐ Very mild

Diagrams showing the Proportion of Cases of Small-pox of the Severe (Hæmorrhagic and Confluent) and Mild (Discrete and very Mild) Types respectively which occurred in Persons at all Ages of different Classes in the London Outbreak of 1892.



ARTHUR P. LUFF.

B.—Report of Dr. Arthur Pearson Luff on the Outbreak of Small-Pox in London during 1892–3.

This report is practically a continuation of my previous report of the outbreak of small-pox that occurred in London from January 1st, 1892, to August 31st, 1892. At the end of that period a few occasional cases of small-pox occurred in London during September, and, towards the end of September or beginning of October, the outbreak now reported on commenced. The origin of the outbreak could not be traced to any one particular case, the importation of the small-pox in connexion with this outbreak being mainly due to its introduction by tramps and other members of the vagrant class from the provinces into London. During the outbreak, but especially at its commencement, the principal foci of infection were, common lodging-houses, casual wards, and Salvation Army shelters, where the members of the migratory and vagrant classes especially congregated. The small-pox in several groups of cases spread with great rapidity amongst the children at various schools, and several illustrations of such spread of infection will be found in the forms marked "A," and "B.," which I forward to the Commission with this report.* Apart from the prevalence of the epidemic amongst tramps and members of the vagrant class, and amongst school-children, those that have been most affected appear to have been, (*a*) men employed in carrying and handling cases of fruit either at the docks, in the markets, or in shops; (*b*) book-folders; (*c*) printers; (*d*) cigar and cigarette makers, and (*e*) employés in the fur trade.

Through the courtesy of Mr. T. Duncombe Mann, the Secretary of the Metropolitan Asylums Board, notification lists of all the small-pox cases that had been notified in London have been transmitted to me as soon as they were received by the Board. As soon as possible after the receipt of these notification lists, visits have been made by myself and by the assistants placed at my disposal by the Treasury, to the houses or places where the cases occurred, and in this way thorough inquiries into the individual cases have been instituted, and, where it has been possible to see the patients, examinations and measurements of the vaccination scars have been made. In addition, I have availed myself of the very thorough examinations that are made of the patients admitted to the hospital ships at Long Reach, and I am greatly indebted both to the officials of the Metropolitan Asylums Board, and to Dr. Ricketts, the Medical Superintendent at the Hospital Ships, for the way in which they have placed all information obtainable at my disposal. I am also much indebted for various particulars that have been kindly furnished me from time to time by the Medical Officers of Health for the different London districts. On the forms marked "A." will be found the particulars of the individual cases and also the source or sources of infection which have been traced in the majority of cases. Fuller particulars of the individual cases will be found on the forms marked "B."

From September 1892 to July 31st, 1893, I received from the Metropolitan Asylums Board notifications of 2,726 cases of small-pox. Of these, 2,087 proved, on instituting inquiries, to be cases of small-pox. 127 of the cases proved to be cases of chicken-pox. 86 of the cases proved to be neither small-pox nor chicken-pox, but some other disease, in several of the cases the disease being syphilis. The remaining 426 were cases that had been notified to me twice over. Of the 2,087 cases of small-pox I have obtained the following particulars. Whether vaccinated, re-vaccinated, or unvaccinated, information has been obtained in 2,074 cases, no information beyond the fact of infection with small-pox in 13 cases. (In connection with these cases no information could be obtained, owing to the people having removed and left no addresses, but in none of these cases could I hear of any instance of death having occurred.) Of the 2,074 cases, I ascertained that 295 (14·2 per cent. of the whole) occurred in children under 10 years of age. Of the 2,074 cases that were successfully inquired into, 370 were unvaccinated, and in 165 other cases the vaccination was doubtful by reason of absence of marks from the arm, no scars being visible in any of these 165 cases. Deducting these 535 cases (unvaccinated and doubtful vaccination cases) from the 2,074 cases, 1,539 cases are left representing those who had been vaccinated, thus:—

Cases concerning which information was obtained:

Vaccinated cases -	1,539
Unvaccinated cases -	370
Doubtful vaccination cases -	165
	2,074

Of the 1,539 cases that had been vaccinated the following particulars were obtained:—

As to whether re-vaccinated or not in all the cases.
Number of vaccination scars in 1,383 cases.
Foveation or not of the vaccination scars in 1,383 cases.
Area of the vaccination scars in 1,205 cases.

The meanings attached to the terms "vaccinated class," "re-vaccinated class," and "unvaccinated class" in this report are the same as those given in my previous report, and in Dr. Barry's Report on the Sheffield Small-pox Epidemic of 1887 to 1888. "'Vaccinated class' includes all persons successfully vaccinated at any period exceeding 13 days prior to the appearance on them of the eruption of small-pox."

"'Unvaccinated class' includes all persons who have either never been successfully vaccinated, or whose vaccination was performed for the first time within 13 days of the appearance on them of the eruption of small-pox."

"'Re-vaccinated class' includes all persons successfully re-vaccinated at any period exceeding 13 days prior to the appearance on them of the eruption of small-pox."

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* *Not here reproduced.*

TABLE I.

Age Period.	No.	Deaths.	All Cases.					Vaccinated																									
			Nature of Attack.					Nature of Attack in reference to Number																									
								One Scar.										Two Scars.										Three				
								Foveated.					Unfoveated.					Foveated.					Unfoveated.					Foveated.				
								Nature of Attack.					Nature of Attack.					Nature of Attack.					Nature of Attack.					Nature of Attack.				
			Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.
Under 1 year.	27	19	1				0	0				0	0				0	0				0	0				0	0				0
				9			3		0			0		0			0		0			0		0			0		0			0
					8		8			0		0			0		0			0		0			0		0			0		0
						9	8				0	0				0	0				0	0				0	0				0	0
1 to 5 years.	103	21	0				0	0				0	0				0	0				0	0				0	0				0
				46			2		1			0		0			0		1			0		2			0		0			0
					19		0			0		0			0		0			0		0			0		0			0		0
						38	19				0	0				0	0				0	0				0	0				0	0
5 to 10 years.	165	14	4				0	0				0	0				0	1				0	0				0	1				0
				92			1		4			0		2			0		6			0		1			0		10			0
					22		0			0		0			0		0			0		0			0		0			1		0
						47	13				0	0				0	0				0	0				0	0				1	0
10 to 15 years.	197	8	4				0	0				0	0				0	1				0	0				0	0				0
				156			0		5			0		7			0		13			0		5			0		9			0
					8		0			0		0			1		0			0		0			0		0			1		0
						29	8				0	0				0	0				0	0				0	0				0	0
15 to 20 years.	288	6	4				0	0				0	0				0	0				0	0				0	1				0
				243			2		11			0		12			0		29			0		5			0		43			1
					5		0			0		0			1		0			0		0			0		0			0		0
						36	4				1	0				1	0				0	0				1	0				1	0
20 to 30 years.	617	28	11				0	0				0	0				0	0				0	0				0	5				0
				523			3		56			1		20			0		85			0		26			0		95			0
					20		1			2		0			0		0			0		0			3		1			0		0
						63	24				0	0				4	2				4	2				4	2				5	1
30 to 40 years.	362	26	8				0	0				0	0				0	1				0	0				0	0				0
				297			2		34			1		25			0		43			0		27			0		44			0
					7		2			1		1			1		0			2		0			0		0			0		0
						50	22				7	2				5	0				0	0				4	3				3	0
40 years and upwards.	315	35	1				0	0				0	0				0	0				0	0				0	1				0
				256			7		26			0		36			0		27			0		24			0		15			0
					7		0			0		0			2		0			0		0			0		0			1		0
						51	28				3	1				2	0				1	1				4	2				2	1
Totals.	2,074	157	33				0	0				0	0				0	3				0	0				0	8				0
				1622			20		137			2		102			0		204			0		90			0		216			1
					96		11			3		1			5		0			2		0			3		1			3		0
						323	126				11	3				12	2				5	3				13	7				12	2

TABLE I.

s.																																	
Character of Scars.														Nature of Attack in reference to Area of Scars.															No. and Area of Scars unknown.				
				Four Scars or more.										Area under ¼ sq. Inch.					Area from ¼ to ½ sq. Inch.					Area over ½ sq. Inch.									
Unfoveated.				Foveated.					Unfoveated.																								
ture of Attack.				Nature of Attack.					Nature of Attack.					Nature of Attack.					Nature of Attack.					Nature of Attack.					Nature of Attack.				
Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.	Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.
			0	0				0	0				0	0				0	0				0	0				0	0				0
0			0		0			0		0			0		0			0		0			0		0			0		3			0
	0		0			0		0			0		0			0		0			0		0			0		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0
			0	0				0	0				0	0				0	0				0	0				0	0				0
0			0		2			0		1			0		3			0		2			0		1			0		5			0
	0		0			0		0			0		0			0		0			0		0			0		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0
			0	1				0	0				0	1				0	3				0	0				0	0				0
2			0		10			0		6			0		9			0		13			0		16			0		9			0
	0		0			0		0			0		0			1		0			0		0			0		0			0		0
		0	0				0	0				0	0				0	0				1	0				0	0				0	0
			0	3				0	0				0	0				0	2				0	2				0	0				0
6			0		46			0		21			0		16			0		23			0		60			0		15			0
	0		0			0		0			0		0			1		0			1		0			0		0			0		0
		0	0				0	0				0	0				0	0				0	0				0	0				0	0
			0	2				0	0				0	0				0	1				0	2				0	0				0
10			0		75			1		28			0		21			0		37			1		138			1		9			0
	0		0			0		0			0		0			0		0			0		0			0		0			0		0
		0	0				1	0				0	0				0	0				0	0				1	0				0	0
			0	3				0	1				0	0				0	1				0	8				0	2				0
24			0		115			0		32			1		57			0		111			1		244			1		38			0
	0		0			0		0			1		0			2		0			1		0			2		1			0		0
		5	1				1	1				1	0				3	0				3	1				10	5				3	1
			0	3				0	2				0	0				0	2				0	4				0	1				0
25			0		28			1		26			0		41			1		76			0		102			1		27			0
	1		1			0		0			0		0			3		1			1		0			0		0			0		0
		3	0				2	1				0	0				8	1				7	3				6	2				2	2
			0	0				0	0				0	0				0	1				0	0				0	0				0
22			1		20			0		20			0		54			0		51			0		38			0		35			2
	1		0			0		0			0		0			1		0			0		0			1		0			2		0
		1	0				0	0				1	1				6	2				1	1				3	1				3	0
			0	12				0	3				0	1				0	10				0	16				0	3				0
89			1		296			2		134			1		201			1		313			2		599			3		143			2
	2		1			0		0			1		0			8		1			3		0			3		1			2		0
		9	1				4	2				2	1				19	3				12	5				20	8				8	3

TABLE I—*continued.*

Age Period.	Re-vaccinated													
	Re-vaccinated Once.							Re-vaccinated Twice.						
	No.	Deaths.	Nature of Attack.					No.	Deaths.	Nature of Attack.				
			Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.			Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.
Under 1 year	0	0	0	0	0	0	0 0 0 0	0	0	0	0	0	0	0 0 0 0
1 to 5 years	0	0	0	0	0	0	0 0 0 0	0	0	0	0	0	0	0 0 0 0
5 to 10 years	1	0	0	1	0	0	0 0 0 0	0	0	0	0	0	0	0 0 0 0
10 to 15 years	0	0	0	0	0	0	0 0 0 0	0	0	0	0	0	0	0 0 0 0
15 to 20 years	5	0	0	5	0	0	0 0 0 0	0	0	0	0	0	0	0 0 0 0
20 to 30 years	22	0	2	20	0	0	0 0 0 0	1	0	0	1	0	0	0 0 0 0
30 to 40 years	31	1	2	27	0	2	0 0 0 1	4	0	0	3	0	1	0 0 0 0
40 years and upwards	28	2	0	26	0	2	0 1 0 1	4	0	0	4	0	0	0 0 0 0
Totals	87	3	4	79	0	4	0 1 0 2	9	0	0	8	0	1	0 0 0 0

TABLE I—*continued.*

Cases.																				
Re-vaccinated Three Times or more.							Vaccination doubtful. No Scars visible.							Unvaccinated Cases.						
No.	Deaths.	Nature of Attack.					No.	Deaths.	Nature of Attack.					No.	Deaths.	Nature of Attack.				
		Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.			Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.			Very mild.	Discrete.	Severe discrete.	Confluent.	Deaths.
0	0	0	0	0	0	0 0 0 0	0	0	0	0	0	0	0 0 0 0	24	19	1	6	8	9	0 3 8 8
0	0	0	0	0	0	0 0 0 0	4	1	0	1	1	2	0 0 0 1	87	20	0	33	18	36	0 2 0 18
0	0	0	0	0	0	0 0 0 0	15	5	0	4	2	9	0 0 0 5	94	9	0	38	19	37	0 1 0 8
0	0	0	0	0	0	0 0 0 0	16	0	0	10	0	6	0 0 0 0	47	8	0	18	6	23	0 0 0 8
0	0	0	0	0	0	0 0 0 0	22	1	0	9	3	10	0 0 0 1	34	3	1	11	1	21	0 0 0 3
0	0	0	0	0	0	0 0 0 0	29	7	0	12	3	14	0 0 0 7	53	8	0	20	11	22	0 1 0 7
1	0	1	0	0	0	0 0 0 0	29	9	0	15	2	12	0 0 0 9	15	5	0	3	0	12	0 0 0 5
0	0	0	0	0	0	0 0 0 0	50	13	0	29	0	21	0 3 0 10	16	13	0	2	1	13	0 1 0 12
1	0	1	0	0	0	0 0 0 0	165	36	0	80	11	74	0 3 0 33	370	85	2	131	64	173	0 8 8 69

Table I. gives:—

(1.) The number of attacks at different age periods.
(2.) The number of deaths.
(3.) The nature of the attack and the number of deaths occurring with each variety of small-pox.
(4.) The influence of the number, and the foveation or not of the vaccination scars; and the area of the vaccination scars on (*a*) the nature of the attacks, (*b*) the mortality.
(5.) The number of attacks amongst those who were known to have been vaccinated, but in connexion with whom the number and nature of the scars could not be ascertained. The nature of the attack and the mortality is also given in this column.
(6.) The influence of re-vaccination on (*a*) the nature of the attack, (*b*) the mortality.
(7.) The number of doubtful cases of vaccination with the nature of the attack and the mortality.
(8.) The number of unvaccinated cases with the nature of the attack and the mortality.

In all these groups special columns show the number of deaths that occurred with each variety of small-pox. In connexion with this report the cases of hæmorrhagic small-pox have been classed with the confluent under the heading "confluent." The actual number of hæmorrhagic cases that occurred was 11.

Of the 1,539 cases occurring among vaccinated persons, 36 proved fatal; of the 370 cases occurring among unvaccinated persons, 85 proved fatal; of the 165 cases occurring among persons whose vaccination was doubtful, 36 proved fatal. These figures converted to percentages give the following results:—

TABLE II.

Fatality as a Per-centage among the Vaccinated and Unvaccinated.

Per-centage of Vaccinated.	Per-centage among those whose Vaccination was doubtful.	Per-centage of Unvaccinated.
2·3	21·8	22·9

A comparison of the fatality as a per-centage among the total sufferers, the vaccinated cases, the cases of doubtful vaccination, and the unvaccinated cases gives the following results:—

TABLE III.

——	No.	Deaths.	Per-centage of Deaths.
Total sufferers - -	2,074	157	7·5
Vaccinated cases -	1,539	36	2·3
Doubtful cases - -	165	36	21·8
Unvaccinated cases -	370	85	22·9

From this table it is seen that the mortality amongst the unvaccinated cases was nearly 10 times that of the vaccinated class. Had the unvaccinated cases died at the rate of the vaccinated class, in place of the 85 deaths there would have been between 8 and 9 deaths. Had the vaccinated cases died at the rate of the unvaccinated class, in place of 36 deaths there would have been 353.*

With regard to the mortality at different ages among the vaccinated and unvaccinated cases (all reference to "doubtful" cases being here and henceforth omitted), the following summary is obtained:—

TABLE IV.

Age Periods.	Vaccinated.			Unvaccinated.		
	Cases.	Deaths.	Per-centage of Deaths.	Cases.	Deaths.	Per-centage of Deaths.
0 to 1 year - -	3	0	0·0	24	19	79·1
1 to 5 years -	12	0	0·0	87	20	22·9
5 to 10 years -	56	0	0·0	94	9	9·5
10 to 15 years -	134	0	0·0	47	8	17·0
15 to 20 years -	232	2	0·8	34	3	8·8
20 to 30 years -	535	13	2·4	53	8	15·0
30 to 40 years -	318	12	3·7	15	5	33·3
40 years and over -	249	9	3·6	16	13	81·2

From this table it is seen that under 10 years of age no deaths occurred among the vaccinated; whereas among the unvaccinated under 10 years of age who caught small-pox 23·4 per cent. of deaths occurred. Over 10 years of age the per-centage of deaths among the vaccinated was 2·4, and among the unvaccinated 22·4. The table also shows that vaccination gave absolute protection against death up to the age of 15 years, whereas among the unvaccinated cases up to 15 years of age the fatality was 22·2 per cent.

Proceeding now to the consideration of the facts as to the nature or severity of attack among the vaccinated and unvaccinated, the following are the results:—

TABLE V.

For all Ages.

Nature of Attack.	Vaccinated.	Unvaccinated.
Very mild - - -	31	2
Discrete - - -	1,411	131
Severe discrete - -	21	64
Confluent - - -	76	173
Totals - - -	1,539	370

From this table it is seen that of the 1,539 vaccinated persons attacked, 76, or 4·9 per cent., had confluent small-pox, whereas of the 370 unvaccinated persons attacked, 173, or 46·7 per cent., had confluent small-pox. Putting the severe discrete and confluent cases together, it appears that 6·3 per cent. of the vaccinated had bad attacks, whilst 64·0 per cent. of the unvaccinated had bad attacks. The chances of a bad attack among the unvaccinated as compared with the vaccinated being 10 to 1. In connexion with the 76 cases of confluent small-pox occurring in vaccinated persons, 24 deaths (a mortality of 31·5 per cent.) occurred, and in connexion with the 173 cases of confluent small-pox occurring in unvaccinated persons, 69 deaths (a mortality of 39·8 per cent.) occurred.

If now the figures are taken as to the nature or severity of attack among the vaccinated and unvaccinated under 10 years of age, the following results are obtained:—

TABLE VI.

Under 10 Years of Age.

Nature of Attack.	Vaccinated.	Unvaccinated.
Very mild - - -	4	1
Discrete - - -	65	77
Severe discrete - -	1	45
Confluent - - -	1	82

---

* Had the cases of doubtful vaccination died at the rate of the vaccinated class, in place of the 36 deaths, there would have been 3·8 deaths; had they died at the rate of the unvaccinated class in place of the 36 deaths, there would have been 37·9 deaths.

Putting the severe discrete and confluent cases together, it can be calculated from this table that under 10 years of age 2·8 per cent. of the vaccinated had bad attacks, whereas 61·9 per cent. of the unvaccinated had bad attacks.

With regard to the facts obtained as to the nature or severity of attack, and the per-centages of deaths among the vaccinated, re-vaccinated, and unvaccinated classes, the results are arranged in Table VII.

TABLE VII.

—	No. of Cases.	Nature of Attack.		Number of Deaths.	Per-centage of Deaths.
		Mild.	Severe.		
Vaccinated once -	1,442	1,350	92	33	2·2
Re-vaccinated -	97	92	5	3	3·0
Unvaccinated -	370	133	237	85	22·9

As regards the age incidence of the vaccinated and unvaccinated persons attacked, the following are the numbers:—

TABLE VIII.

Age Incidence of Vaccinated Persons attacked.

Under 10 Years.	Over 10 Years.
71	1,468

Age Incidence of Unvaccinated Persons attacked.

Under 10 Years.	Over 10 Years.
205	165

From these numbers it is seen that amongst the vaccinated comparatively very few were attacked under 10 years of age, whereas amongst the unvaccinated the greater number of attacks occur under 10 years of age. With regard to the re-vaccinated cases, of the 1,539 vaccinated cases, 97 had been re-vaccinated, and of these 97 re-vaccinated cases, 87 had been re-vaccinated once, 9 had been re-vaccinated twice, and one had been re-vaccinated three times. Reducing these numbers of the re-vaccinated cases to per-centages of the total vaccinated cases, the following table is obtained:—

TABLE IX.

—	Nos.	Re-vaccinated Cases stated as Per-centages of Total Vaccinated Cases.
Re-vaccinated once -	87	5·6
Re-vaccinated twice -	9	0·5
Re-vaccinated three times -	1	0·06

With regard to the facts as to the nature of attack and the mortality among the vaccinated, the 1,539 cases of vaccination resolve themselves thus:—(In this table 3 deaths occurring among vaccinated persons and which are classed among the deaths in Table I. are omitted, since, on inquiry, it was ascertained that death in these 3 cases did not occur from small-pox. They were all cases of discrete small-pox, and in one of them death was due to rheumatic fever and heart disease, in the second to pneumonia, and in the third to convulsions.)

TABLE X.

Vaccinated Cases.

Nature of Attack.	No.	Deaths.
Very mild - - -	31	0
Discrete - - -	1,411	6
Severe discrete - -	21	3
Confluent - - -	76	24

Setting out the facts in tabular fashion as to the nature of attack at different ages among the vaccinated, the following table is obtained:—

TABLE XI.

Vaccinated Cases.

Age Periods.	Nature of Attack.				Per-centage of Cases.			
	Very mild.	Discrete.	Severe discrete.	Confluent.	Very mild.	Discrete.	Severe discrete.	Confluent.
0 to 1 year -	0	3	0	0	0·0	100·0	0·0	0·0
1 to 5 years -	0	12	0	0	0·0	100·0	0·0	0·0
5 to 10 years -	4	50	1	1	7·1	89·3	1·8	1·8
10 to 15 years -	4	128	2	0	3·0	95·5	1·5	0·0
15 to 20 years -	3	223	1	5	1·3	96·1	0·5	2·1
20 to 30 years -	11	491	6	27	2·1	91·8	1·1	5·0
30 to 40 years -	8	279	5	26	2·5	87·8	1·6	8·1
40 years and over -	1	225	6	17	0·4	90·3	2·4	6·9

From this table it is seen that up to five years of age small-pox in vaccinated persons was entirely of a mild nature, and that from 5 to 20 years of age it only appeared among the vaccinated in a severe form in a small proportion of the cases; whereas after 20 years of age the proportion of the severe cases is much greater.

The data obtained showing the relation existing between the number of vaccination scars and the nature of attack give the following results:—

TABLE XII.

Age Periods.	One Scar.		Two Scars.		Three Scars.		Four Scars.	
	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.
0 to 1 year -	0	0	0	0	0	0	0	0
1 to 5 years -	1	0	3	0	0	0	3	0
5 to 10 years -	6	0	8	0	14	2	17	0
10 to 15 years -	12	1	19	0	15	1	70	0
15 to 20 years -	23	3	34	1	54	1	105	1
20 to 30 years -	76	6	111	11	124	10	151	3
30 to 40 years -	59	14	71	6	70	7	59	2
40 years and over -	62	7	51	5	38	5	40	1
Total - -	239	31	297	23	315	26	445	7

From this table the following relative numbers of discrete and severe discrete or confluent attacks in relation to the number of vaccination scars can be deduced:—

For all Ages.

1 scar.—8 cases of discrete to 1 case of severe or confluent occurred.

2 scars.—13 cases of discrete to 1 case of severe or confluent occurred.

3 scars.—12 cases of discrete to 1 case of severe or confluent occurred.

4 scars.—63 cases of discrete to 1 case of severe or confluent occurred.

Under 20 *Years of Age.*

1 scar.—10 cases of discrete to 1 case of severe or confluent occurred.

2 scars.—64 cases of discrete to 1 case of severe or confluent occurred.

3 scars.—21 cases of discrete to 1 case of severe or confluent occurred.

4 scars.—195 cases of discrete to 1 case of severe or confluent occurred.

These results fairly bear out the conclusion that the greater the number of vaccination scars, the less severe is the nature of the attack.

Taking next into consideration the influence of foveated and unfoveated scars upon the nature of attack, the following are the results:—

TABLE XIII.

Age Periods.	One Scar.				Two Scars.				Three Scars.				Four Scars.			
	Foveated.		Unfoveated.		Foveated.		Unfoveated.		Foveated.		Unfoveated.		Foveated.		Unfoveated.	
	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.
0 to 1 year - .. -	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1 to 5 years - - -	1	0	0	0	1	0	2	0	0	0	0	0	2	0	1	0
5 to 10 years - -	4	0	2	0	7	0	1	0	11	2	3	0	11	0	6	0
10 to 15 years - -	5	0	7	1	14	0	5	0	9	1	6	0	49	0	21	0
15 to 20 years - -	11	1	12	2	29	0	5	1	44	1	10	0	77	1	28	0
20 to 30 years - -	56	2	20	4	85	4	26	7	100	5	24	5	118	1	33	2
30 to 40 years - -	34	8	25	6	44	2	27	4	44	3	26	4	31	2	28	0
40 years and over - -	26	3	36	4	27	1	24	4	16	3	22	2	20	0	20	1
Total cases - -	137	14	102	17	207	7	90	16	224	15	91	11	308	4	137	3

Reducing these to per-centages of severe and confluent attacks among those of all ages having foveated or unfoveated vaccination scars, the results are as follows:—

TABLE XIV.

ALL AGES.

—	One Scar.		Two Scars.		Three Scars.		Four Scars,	
	Foveated.	Unfoveated.	Foveated.	Unfoveated.	Foveated.	Unfoveated.	Foveated.	Unfoveated.
Per-centages of severe and confluent attacks.	9·2	14·2	3·2	15·0	6·2	10·7	1·2	2·1

This table shows that a considerably higher per-centage of severe and confluent attacks occur among those having unfoveated scars than among those having foveated scars. This becomes more apparent if the figures are lumped together under each of the sub-headings, when the following results are obtained:—

TABLE XV.

No of Scars.	Foveated.		Unfoveated.	
	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.
One scar - -	137	14	102	17
Two scars - -	207	7	90	16
Three scars - -	224	15	91	11
Four scars - -	308	4	137	3
Total cases -	876	40	420	47
Per-centages -	95·7	4·3	90·0	10·0

This shows that more than twice as many cases of severe discrete and confluent small-pox occurred among those having unfoveated vaccination scars as among those having foveated scars. By looking to the death rates the results bear out a similar conclusion.

TABLE XVI.

No. of Scars.	Foveated.			Unfoveated.		
	Cases.	Deaths.	Mortality per Cent.	Casos.	Deaths.	Mortality per Cent.
One scar - -	151	5	3·3	119	2	1·6
Two scars - -	214	3	1·4	106	8	7·5
Three scars - -	239	2	0·8	102	3	2·9
Four scars - -	312	3	0·9	140	2	1·4
Totals - -	916	13	1·4	467	15	3·2

These results indicate that foveation of cicatrices is superior in protecting against death as compared with unfoveated scars.

Taking, lastly, into consideration the influence of the combined area of the vaccination scars upon the nature of attack, the following are the results:—

TABLE XVII.

Age Periods.	Area of Scars under ·25 sq. in.		Area of Scars from ·25 to ·5 sq. in.		Area of Scars over .5 sq. in.	
	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.	Discrete.	Severe and Confluent.
0 to 1 year -	0	0	0	0	0	0
1 to 5 years -	3	0	2	0	1	0
5 to 10 years -	10	1	16	1	16	0
10 to 15 years -	16	1	25	1	62	0
15 to 20 years -	21	2	38	0	140	1
20 to 30 years -	57	5	112	4	252	12
30 to 40 years -	41	11	78	8	106	6
40 years and over -	54	7	52	1	38	4
Totals -	202	27	323	15	615	23

If these figures are worked out so as to show the percentages of severe and confluent attacks at all ages when the area of the vaccination scar is respectively under ·25 square inch, from ·25 to ·5 square inch, and over ·5 square inch, the following table is obtained:—

TABLE XVIII.
All Ages.

—	Area of Scars under ·25 sq. in.	Area of Scars from ·25 to ·5 sq. in.	Area of Scars over ·5 sq. in.
Per-centages of severe and confluent attacks	11·7	4·4	3·6

or, if the figures are worked out so as to show the percentages of very mild attacks at all ages, when the area of the vaccination scars is respectively under ·25 square inch, from ·25 to ·5 square inch, and over ·5 square inch, the following Table is obtained:—

TABLE XIX.
All Ages.

—	Area of Scars under ·25 sq. in.	Area of Scars from ·25 to ·5 sq. in.	Area of Scars over ·5 sq. in.
Per-centages of very mild attacks	0·4	2·9	2·5

Reducing the figures of Table XVII to proportions of discrete to confluent attacks, the results are as follows:—

TABLE XX.

Area of Scars.	Proportion of Discrete to Confluent cases.
Area of scars under ·25 sq. in	7 Discrete cases to 1 Confluent
Area of scars from ·25 to ·5 sq. in.	21 ,, ,,
Area of scars over ·5 sq. in.	26 ,, ,, ,,

By looking to the death rates similar results are obtained:—

TABLE XXI.

Area of Scars.	Cases.	Deaths.	Mortality per Cent.
Area of scar under ·25 sq. in.	229	5	2·1
Area of scars from ·25 to ·5 sq. in.	338	6	1·7
Area of scar over ·5 sp. in.	638	10	1.5

The results shown in Tables XVIII., XIX., XX., and XXI. show that the greater the combined area of the vaccination scars the greater is the protection against a bad attack of small-pox, and also the lower is the death-rate.

Diagram showing the Proportion of Cases of Small-pox of the Mild (including very mild and Discrete Cases), and Severe (including Severe Discrete, Confluent, and Hæmorrhagic Cases) Types respectively, which occurred in Persons at all Ages of different classes in the London Small-pox Outbreak from September 1st, 1892, to July 31st, 1893.

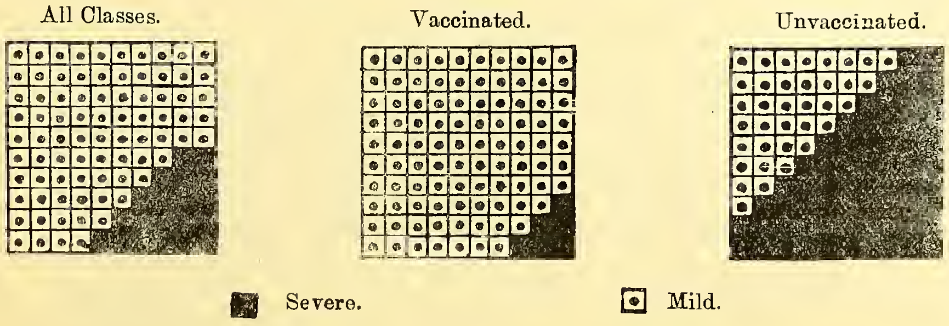
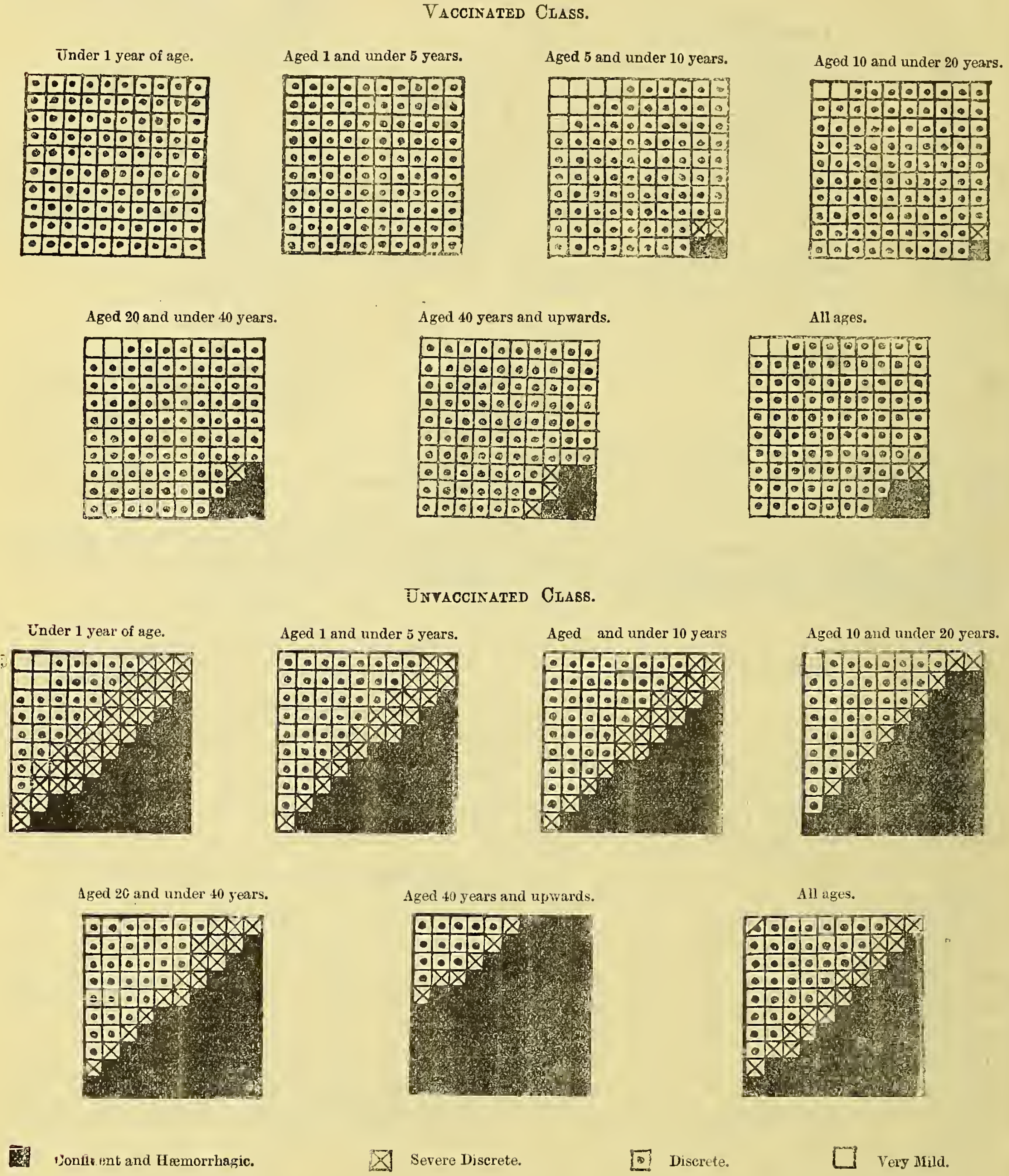


DIAGRAM showing the Proportion of Cases of Small-pox of different Types which occurred in Persons of the "Vaccinated" and "Unvaccinated" Classes respectively at all and certain specified Ages in the London Small-pox Outbreak from September 1st, 1892, to July 31st, 1893.



These diagrams show at a glance the proportion of cases of small-pox of different types which occurred at all and certain specified ages among the vaccinated and unvaccinated classes respectively.

ARTHUR P. LUFF.

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VACCINATION COMMISSION.

APPENDIX V.

TO THE

FINAL REPORT

OF THE

ROYAL COMMISSION ON VACCINATION.

REPORT TO THE COMMISSION OF

DR. THOMAS DIXON SAVILL

ON THE OUTBREAK OF SMALL-POX IN THE BOROUGH OF WARRINGTON IN 1892-3.

Presented to both Houses of Parliament by Command of Her Majesty.

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Report of Dr. Thomas Dixon Savill on the Outbreak of Small-pox in the Borough of Warrington in 1892-3.

INTRODUCTION.

Advantages special to this inquiry.

The Warrington small-pox epidemic of 1892-93 offers certain advantages for the observation of that malady as it occurs in the present day, and for the investigation of those circumstances connected both with the individual and his surroundings which may influence the propagation and severity of the disease.

1. The study of the malady has been carried on in recent years very largely among small-pox patients after their admission to the small-pox hospitals. But in a community having reasonable and well-defined limits, like the Borough of Warrington, one is enabled to study pretty closely the conditions of all the people exposed to infection, both those attacked and *those also who escaped.* For example, by personal house-to-house inspection it was possible to ascertain the vaccinated condition of *all the persons in the infected houses*, upwards of 2,500 in number. Of these 107 were unvaccinated—of whom 56 per cent. were attacked and 19 per cent. died; and 1,500 were " well vaccinated "—of whom 21 per cent. were attacked and 0·6 per cent. died. (Table X.).

2. The inhabitants of Warrington very largely consist of the artisan and labouring classes, living in houses of a very uniform type (photo. p. 81), and under very similar conditions of home and social life. The disease arose almost entirely amongst these folk and presented, therefore, none of those mixed hygienic or social conditions which would lead to fallacy.

3. The proportion of persons who had been vaccinated once in their lives was unusually high, whereas very few had been revaccinated in the infected houses, or, so far as could be judged, in the town generally, previous to the epidemic; and thus is offered a good opportunity for the study of small-pox in relation to primary vaccination as distinct from revaccination.

4. Small-pox was in former times endemic in Warrington, and 120 years ago the town was the scene of an outbreak of small-pox the like of which has not been known in modern times. The valuable records of this epidemic, given in the proceedings of the Royal Society, and other publications of that epoch, will enable one, with some degree of accuracy to gauge the remarkable differences between the epidemic of 1773 and that of 1892–3. These records show that the mean annual death-rate from the disease in 1773 was 24 times as great as that of 1892–3.

5. Finally, the distribution of the infected houses is a feature which adds still further to the interest and importance of the inquiry in relation to the question whether small-pox was, in this outbreak, spread by means of aërial diffusion. A large number of cases arose, at first, in the neighbourhood of the Old Borough Fever Hospital, while small-pox patients were there admitted. Subsequently, a temporary small-pox hospital was provided in the northern part of the town, and then an undue proportion of houses became infected in its neighbourhood.

Division of Subject.

The evidence revealed during this enquiry will be grouped into four divisions:

Part I. gives the origin and progress of the small-pox epidemic in the borough, and the action taken by the local authorities. It also presents a statement of the cost incurred.

Part II. is devoted to the relation of vaccination to small-pox. An account of the historical epidemic of 1773 is also given, and of the occurrence of small-pox in Warrington so far as it is known since that date.

Part III. deals with those measures especially directed against infectious disease—recognition, notification, removal of patient, quarantine of friends, hospital provision. The concluding sections of this part also deal with the evidence for and against the hypothesis of infection, during this outbreak, by aërial currents.

Part IV. refers to various social, hygienic, and other conditions which might be regarded as contributory causes of the outbreak; such as locality, houses, sanitation, refuse removal, water supply, geology, meteorology, and the occupations and habits of the people.

Only such facts are recorded as have borne full investigation and confirmation, and no pains have been spared with this object in view. The enquiry extended from December 1st, 1892, four months after the epidemic really started, to February 19th, 1894; and the greater part of the time was spent on the spot, in visiting the cases, either in hospital or at home, or both; visiting the other occupants of the infected houses; and making other inquiries necessary to procure first-hand information. The facts so obtained will be given in the fullest manner possible, and on this account the report has come to be of considerable dimensions.

The period dealt with is from May 10, 1892, when a preliminary outbreak commenced, to May 10, 1893, during which time 667 cases occurred in a population of 54,084 persons of whom 62 died. Only 24 cases arose after the latter date, and the temporary hospital was closed in August 1893.

Where evidence has been obtained second-hand, the source has for the most part been acknowledged, but I wish to acknowledge in general terms my indebtedness for valuable assistance received. The Town Clerk Mr. J. Lyon Whittle, the Medical Officer of Health Mr. John H. Gornall, the Assistant Medical Officer of Health Dr. J. Guest Gornall, the Borough Surveyor Mr. Thomas Longdin, the Clerk to the Guardians Mr. James C. Sutton, the Vaccination Officer Mr. George Holford, the Librarian of the Public Free Library Mr. Chas. Madeley, the master and matron of the Workhouse Mr. and Mrs. C. H. Ward, the Manager of the Dallam and Bewsey Forge Mr. Thos. Morris, and the Managers of the other works in the town, have all afforded me valuable information and facilities for investigation.

To Drs. W. E. Fielden and W. W. Lake, who assisted me during part of the time, to Messrs. W. H. Woodcock and Edward Gibbon, whose precision and local knowledge were of the greatest use to me, and to Mr. W. J. Welch, junr., who aided me in the calculations, thanks are specially due for the valuable help they rendered.

Preliminary considerations.

Before presenting a statement of the facts ascertained during my enquiry, I may perhaps be permitted to refer briefly to several points to which certain of the facts relate.

Period of incubation.

The *period of time* which elapses between infection and the development of symptoms of small-pox is in many ways a point of considerable importance in an investigation of this kind. Since the commencement of the inquiry an authoritative statement on the subject has appeared in the Report of a Committee of the Clinical Society of London on Incubation and Contagion.* This committee gives further confirmation of the remarkable constancy of the incubation period of small-pox, and shows that the eruption very generally appears on the 14th day after infection. In 42 out of 54 cases arising after a probable single exposure, given on p. 182 of their Report, it was so. A patient, for example, exposed to infection on December 31st would develop the eruption on January 14th.

Nevertheless, the same authority mentions exceptional cases where this interval has been as short as 12 days and as long as 23 days. Allowance should always be made for such cases, but, when a fixed date is required for calculation, 14 days will be used in the following pages.

Practically this was found to be the period of incubation in the majority of the Warrington cases. The exceptions were not numerous, but it will be noticed that the only case which arose as a consequence of cases *a*, *b*, and *c*, developed the eruption on the 16th day after exposure.

How infection may be spread.

The question of *how small-pox may be propagated* is also a point of considerable importance. It has appeared to me to be essential in this connexion to remember the highly infectious nature of small-pox. It is strange that this feature should have been overlooked by that great clinical observer, Sydenham; but ever since the days of Boerhaave (1730) this fact has been recognised. Many instances occurred in the course of this outbreak where small-pox was contracted, although, as far as could be ascertained, the exposure to infection was very brief. Some instances occurred where the distance from the source of infection was, in all probability, considerable; such, for example, as case 60, who took some flowers to the Old Fever Hospital gate once only, 14 days before developing the eruption, but who, having great fear of the disease,

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* Clinical Society's Transactions, Supplement to Vol. XXV. Edited for the Committee by Dr. Dawson Williams.

Query does this intense fear of a disease mean extraordinary capacity of receptivity to infection of the disease ?

did not go in. The small-pox block is 12 yards from the gate, but on the other hand she may have incurred infection fom the gate-porter who habitually removed the small-pox patients.

But cases which afford any precise information as regards the distance through the air to which infection may be transmitted simply by the exhalations from a patient were wanting in the information derived from the Warrington epidemic. Examples which help to elucidate the question are scarce, and the one given below* of an outbreak, started in much the same fashion as that at Warrington, is interesting in this connexion.

Aërial convection; limitation of inquiry.

In endeavouring to ascertain whether *spread by aërial currents* was a causal factor in the outbreak, it has seemed to me unnecessary, in view of the extremely contagious nature of the disease, to consider the question whether small-pox was, in this epidemic, propagated by the diffusion of the exhalations from a patient or patients *within* a radius of 20 yards, *i.e.*, within the radius of an ordinary hospital curtilage. The material derived from the epidemic under consideration does not lend itself to the narrower question; nor is the matter of present importance, for the spread of small-pox within the Fever Hospital was fully explained by *direct* contagion without recourse to the theory of aërial convection. But the main circumstances of the Warrington epidemic render the wider inquiry of great and practical interest, and the facts revealed are of a kind which may enable one to come to some conclusion on the subject. But in the following pages, the inquiry into the question of aërial convection will only relate to whether small-pox was or was not propagated by the spread of infection through the air beyond a distance of 20 yards (p. 69).

In the larger number of cases where small-pox was contracted during the outbreak, the disease was incurred through *direct contact*. In other instances the infection was conveyed indirectly through the *medium of a third person*, as in the cases mentioned on p. 14, or again that of a certain Mrs. S——, who nursed Case 122 for a few hours, was not attacked herself, but took the disease home to her husband. In others, it was conveyed by an *inanimate object*, as in the only case secondary to the preliminary outbreak (p. 8), who beyond doubt took the disease by removing the bedding for disinfection; or again, that of a woman named Ann H——, who washed the clothes of Case 344, and 14 days later she, her husband, and baby, all developed the eruption on the same day.

In all of these three last-named methods, the infection followed the lines of human intercourse; and there were not many cases inexplicable by direct or mediate infection, *i.e.* along the lines of human contact. Moreover, there is some evidence which, in my opinion, supports the view that small-pox was not, in this outbreak, conveyed by air currents, namely, the exemption of two such important communities as the Workhouse and Walker's Brewery from any cases which could not more reasonably be explained by direct infection. These buildings were in the near neighbourhood of the Old and New Hospitals respectively (pp. 69 and 77).

Varieties of small-pox.

The *average type*, or severity, of the cases in this epidemic has been much milder than the typical small-pox described by classical writers.† One half of the cases during the present outbreak were of a very mild kind, attended by very few or no constitutional symptoms after the appearance of the eruption. None of those latter died;

---

* Dr. Sadler, Medical Officer of Health of the Barnsley Borough, narrates an instance of a delirious small-pox patient, who, on the same evening of his admission to the Kendray Hospital at Barnsley, "in a sudden and "unexpected fit of violence, overpowered the assistant nurse temporarily left in charge of him, broke out all "the glass of a large pane, and before assistance arrived had escaped through the window, without any "clothing whatever. He was at once pursued, but found his way over fields into the gardens of some houses "about half a mile away.

"It was 9 o'clock at night, he was never inside a house, and he was brought to the hospital within two hours; but a small crowd managed to collect around him, and of these, six (some of whom assured me they had never been within six or eight yards of him), took the complaint.

"Altogether in Barnsley and the adjoining township, 21 cases were traced with certainty to this man's short "escape from the hospital, and 14 others were in all probability also due to it, besides the two which had been "infected the day before he was removed." (Quoted by Dr. Arthur Whitelegge in his Annual Report to the West Riding County Council, 1893, p. 27).

† Sydenham.—Methodus Curandi Febres, Propriis Observationibus Superstructa. London, 1666, and his other works.

Rhazes.—De Variolis et Morbillis. Channing, London, 1776.

Percival.—Essays, Medical, Philosophical, and Experimental. London, 1789.

Aikin.—Philosophical Transactions, Vol. 64. London, 1774.

See also the copious bibliography in Hirsch's Handbook of Geographical and Historical Pathology. Vol. I., p. 123 *et seq.* New Syd. Society's Publication.

many had not a score of pocks upon them; and during the earlier periods of the epidemic, when the people were not on the look out for the disease, some continued at work without any hesitation, and without any evil consequences to themselves. But some of the cases were of quite a different variety, being severe and the eruption on the face confluent. The proportion of such cases was 21 per cent. among the vaccinated persons and 72 per cent. among the unvaccinated. Definitions of the three varieties of small-pox adopted—Mild, Discrete, and Confluent—will be found on p. 23.

There were numerous illustrations that a mild case may, by infection, give rise to a severe case, and *vice versâ.* Thus, severe cases gave rise to the mild cases 6a, 2, 3, 30a, &c., and the trivial case, 30a, gave rise to the severe cases 31, 57, 98, 112, of whom the last two died—showing that, however wide the variation in severity, the disease is but one clinical entity.

Protective power of previous small-pox.

It happens that Warrington offers exceptional facilities for testing the truth of the proposition that *one attack of small-pox generally confers a lifetime's immunity* from a second attack, owing to the extensive prevalence of the disease in the town and its neighbourhood during this century (p. 41). I have not seen so many pock-marked people in one place since visiting Northern Africa, and I was not surprised at the estimation that about 1·6 per cent. of the inhabitants had previously suffered from the malady. This is doubtless owing to the position of the town of Warrington on the high road to and from Manchester, Liverpool, and other large towns in the north of England, where it constitutes a half-way house for a floating population, who take such a leading part in the spread of infectious disease.

Out of the 667 cases which constituted the Warrington epidemic 0·75 per cent. had been previously attacked with small-pox.

It follows, therefore, that a previous attack does not confer absolute immunity, and, if the evidence I submit be correct, it tends to show that small-pox occurs about as frequently in persons protected by a previous attack of small-pox as it does in persons who have been vaccinated twice or oftener in their lives. The figures are not large, but much care has been taken to eliminate sources of error.

Proximate Causes of the Epidemic.

As regards *the immediate causes which lead to the outbreak,* the evidence, in my opinion, seems to show that the three leading factors in the causation of the Warrington Epidemic, 1892-3, were, in the order in which they become apparent in the narrative (Part I.), as follows:—

1. *Non-recognition* of three of the earlier cases, viz., the 2nd, 3rd, and 4th persons who developed the small-pox eruption, in August. They were seen by a doctor's assistant (alleged to be unqualified) acting in the absence of his principal. Two of them, though apparently well-marked types of small-pox, were treated at home by him as "German measles" for 10 and 7 days respectively; meanwhile the visits of friends and neighbours were unrestricted; and their relatives went to work as usual, or played daily with other children in the adjacent streets or open spaces back and front of the houses in that row. Finally the Medical Officer of Health, hearing rumours of these cases, visited them and they were promptly removed to hospital, where one of them, the unvaccinated child, æt. 10, died three days later. Three of the children of the older case contracted the disease, and altogether 23 cases resulted in their immediate neighbourhood (Narrative, p. 9). The third unrecognised case was a mild one and altogether escaped detection and isolation. This man gave the disease to his wife and an indefinite number of other persons.

2. *Deficient Hospital accommodation* for the isolation of small-pox and other infectious diseases. Sixty-four beds represent the minimum requirements of the Borough of Warrington based on the number of cases of infectious diseases needing isolation which have actually arisen and were notified in the community during the four years 1889–1892; and the total provision at the commencement of the epidemic was 30 beds for all diseases, or less than half the very lowest estimate (page 63). As a consequence of this only 13 cases of small-pox could be received into the Borough Fever Hospital by dangerously overcrowding every available space. The cases therefore, about 60 in number, which arose between August 25th and September 19th, when additional temporary hospital provision was made, were of necessity left in their own homes scattered over the town. Consequently the town became so saturated with infection, and the cases arose so rapidly that the limit of hospital accommodation, even with the additional 159 beds crowded into the temporary hospital, was, for a second time, reached

early in November, and large numbers again had to be left in their homes. In presence of such a condition of affairs it might be a matter for surprise that a no larger proportion than 1·2 per 1,000 of the population was attacked with the disease. When an almost similar state of affairs arose in Warrington in 1773, about 64 per 1,000 of the inhabitants were attacked with the small-pox.

The influence of re-vaccination.

3. *Deficiency of re-vaccination* among the inhabitants before the outbreak. My inquiries in a typical district of the town (Aikin Street area) revealed the fact that only 2·7 per cent. of the inhabitants had been re-vaccinated prior to the epidemic, and there were good reasons for believing that in the town generally this proportion was considerably smaller (p. 43).

From the evidence submitted in the following pages it is rendered highly probable that if more persons had been re-vaccinated prior to the outbreak neither of the other causal factors would have come into operation with so much power. The well re-vaccinated community of 800 persons in the garrison entirely escaped, with the exception of a militiaman who had never been re-vaccinated. These persons (men, women, and children) mixed with the towns folk and largely frequented the public-houses, amusements, and other places of public resort. If, therefore, the inhabitants generally had been similarly well re-vaccinated, it seems probable that they also would have enjoyed a somewhat similar immunity (p. 44). Again, the attack-rate amongst the re-vaccinated persons in infected houses was barely more than half the attack-rate amongst the " well-vaccinated " (p. 27). And, again, a rising outbreak amongst the workmen of the chief Iron Works in the town was suddenly checked within 14 days after the two weeks during which 1,300 or 1,400 of them were re-vaccinated (p. 44).

Finally, *recent* re-vaccination seemed, from the data obtained, to confer a remarkable immunity against the disease, for not one of all the persons attacked with small-pox during the Warrington epidemic 1892–1893 had been successfully re-vaccinated more recently than seven years prior to the epidemic (p. 43), although many, like the staff of the Fever Hospital, were specially exposed to infection. Fully one-third of the population of Warrington were re-vaccinated during the progress of the epidemic, chiefly in the month of November, and not one of all this number contracted small-pox after successful and completed re-vaccination, although, as will be seen, the whole town was pervaded with the infection, and might practically have been regarded, during November and December, as one large infected house. It may reasonably be suggested that this wholesale re-vaccination was one of the circumstances which promoted the decline of the epidemic.

In view of all these and similar circumstances revealed in the following pages, one is led to infer that deficiency of re-vaccination was a considerable factor in the causation of the Warrington epidemic ; and that if the townsfolk had been as well re-vaccinated before the outbreak as they were well vaccinated, the epidemic would never have reached the dimensions which it did, in spite of the apathy of the Sanitary Authority to provide sufficient hospital accommodation, and in spite of the non-recognition of small-pox by the doctor's assistant. These latter, hospital accommodation and recognition, are really remedial measures after the small-pox has arisen, but the former, *re-vaccination,* would seem to be the true means of preventing the appearance of the disease: without it, primary vaccination, as a means of prevention, is apparently incomplete.

Influence of Primary Vaccination on the Epidemic.

Turning, in conclusion, to the subject of Primary Vaccination, it might perhaps, at first sight, be a matter of surprise that a comparatively well vaccinated town like Warrington should have been the scene of such a severe epidemic of small-pox. I estimated that nearly 99·2 per cent. of the inhabitants had been vaccinated once in their lives before the outbreak, almost without exception in infancy (p. 25). But a closer examination of the extremely potent causes in operation on this occasion, coupled with the admitted fact, as shown also in the following pages, that vaccination in infancy does not by any means confer a life-time's immunity, cannot fail to dispel the initial surprise.

A study of the facts elicited in this inquiry shows that primary vaccination exercised a very remarkable *protective power* against small-pox during the early years of life. Two hundred and seventy-two vaccinated persons under 4 years of age were exposed to contagion in the infected houses, and not one of them contracted the disease. There were 30 unvaccinated persons under this age similarly exposed and 14 of them contracted the small-pox. But Table XXXIX. (p. 54), which cost so much labour to prepare and to eliminate all possible sources of error, also shows that after the fourth year the immunity already began slightly to decline. A further decline in the immunity from attack conferred by infantile vaccination occurred in the second decade of life (p. 50), and a still further decline was noticeable in the 3rd and 4th decades. Beyond the age of 40, the confusing circumstance of the immunity of advancing years from most infectious disorders came into operation as a disturbing cause (p. 50).

As regards the power of vaccination to *modify* small-pox, this seemed, from the evidence revealed, also to be very great during the early years of life. Out of 189 vaccinated cases of small-pox under 20 years of age, only 12 were confluent cases and only three died; and inquiry showed that one of these deaths (case 117) was due to a malady quite distinct from the small-pox. The corresponding unvaccinated figures were respectively, 50 cases, 33 confluent cases, and 15 deaths. The first two decades are mentioned together in order to get larger figures for the observation. It will be seen, from the evidence submitted, that the power of primary vaccination to modify, like the power to protect, wore off as age advanced (p. 51).

A study of the age-period, attack-rate, case-severity, and the case-mortality, in the Warrington epidemic seems to show that the power of primary vaccination to modify small-pox, lasted longer by some 20 years than its power to protect from attack; for the power to *protect* was least in the third decade of life, whereas the power to *modify* was least in the fifth decade. It will be seen, however, that neither of these qualities entirely disappeared throughout life, if comparison be made between the different Warrington figures, and between the Warrington vaccinated figures, and the unvaccinated figures of other observers (pp. 50–55).

Important data as to the age when re-vaccination should be performed may be deduced from the foregoing observations.

The statistical facts and circumstances mentioned in Part II. of this Report, which are set forth with so much prolixity in order that they may be fully apparent, are the result of prolonged inquiry. It is obvious from these that there were remarkable *differences* between the attack-rate, case-mortality, age at death, and death-rate of small-pox, as it occurred amongst *unvaccinated* persons in Warrington 1892–1893, and among *vaccinated* persons in Warrington 1892–1893; and also between the disease as it occurred amongst the population of Warrington in 1773 (*unvaccinated*), and amongst the *vaccinated* persons who were attacked in Warrington in 1892–93.

It is also obvious that there are certain points of *similarity* between the disease as it arose amongst the population of Warrington in 1773, and amongst the *unvaccinated* persons who were attacked in 1892–93. These points of similarity are all the more evident, if we bear in mind that, owing to the epidemic prevalence of small-pox in the last century, almost every inhabitant who survived the early years of existence in those times, grew up protected by an attack of the disease, and thus the older decades of life were comparatively exempt.

After exhausting every possible source of information, I was unable to ascertain any adequate cause for these remarkable differences and points of similarity, excepting the circumstance that the several groups of persons were respectively vaccinated or unvaccinated; and the conclusion is irresistible that it was vaccination which afforded protection against, and modification of, small-pox in the earlier decades of life in the Warrington epidemic of 1892–3.

Cost of Epidemic.

The expenditure of the various authorities concerned, in consequence of the Warrington epidemic of 1892–3, was approximately 8,735*l*. But this sum by no means represents the cost of the epidemic to the community. To reckon that cost it is necessary to add to this 8,735*l*., the cost to employers of providing re-vaccination to their workpeople, the amount of the loss of wages of those who contracted small-pox and of their friends at the time of quarantine, the amount of the funeral expenses of those who died and of their value as wage-earners, the cost to the parish and other authorities of those rendered destitute, and the amount of the damage done to the trade of the town. I have, on page 19, attempted to estimate these items; and I find that the cost of the epidemic to the community could not have been less than 22,000*l*.

It will, I think, be rendered evident from a perusal of the following pages that if adequate hospital provision had been made in a properly situated building, and if re-vaccination had been regularly carried out, and the two maintained in an efficient state, then this great cost and the many other, and even more serious, consequences of the epidemic, which cannot find monetary expression, might have been avoided. The proper way to regard all sanitary outlay is as an insurance; and a consideration of these figures may well suggest the reflection whether any investment is calculated to yield a better pecuniary return to a community than the expenditure involved in the operations of a Public Health Department which have for their main object the prevention of such epidemics.

PART I.—Narrative of the Small-pox Epidemic in Warrington, 1892-3; the Steps taken by the Local Authorities to cope with it; and the Cost of the Epidemic.

LEADING FACTS CONCERNING WARRINGTON.

(Dealt with more fully in Part IV.)

The town of Warrington is situated in South Lancashire, about half way on the high road from Liverpool to Manchester. The country around is flat and low-lying, and the town is built on the north bank of the River Mersey. (Map at end.)

Estimated population, Midsummer 1892, } 54,084.*

The population consists almost entirely of the artisan and labouring classes, employed largely in the manufacture of iron.

Inhabited houses, 1892 (estimated), 10,025. Area, 1,968 acres. Average density of population, 5 persons per acre, but in some places (St. John's Ward) 66·8 persons per acre.

Birth rate, 39·9; death rate, 22·7; for the year ended December 31st, 1892.*

Warrington was one of the earliest towns to adopt compulsory notification of infectious diseases, by its insertion in the "Warrington Corporation Lighting and Improvements Act, 1879" (secs. 23, 24, and 25), which came into force in July 1879.

The Corporation, acting by the Council of the borough, is the Urban Sanitary Authority for the borough, with the powers and obligations of an Urban Sanitary Authority.

Vaccination in the Warrington Union, which is not co-terminous with the borough, is, as usual, under the control of the guardians. The medical officer of health and public analyst of the Borough (Mr. John H. Gornall) is also public vaccinator to the Union.

In 1892, it may be estimated that 99·2 per cent. of the inhabitants had been vaccinated in infancy. Only 2·7 per cent. were found to have been re-vaccinated in a typical district of the town prior to August 1892. (Vaccination will be dealt with in detail in Part II. of this Report.)

The certified accommodation of the borough fever hospital (Aikin Street) for all classes of infectious disease in 1881† was 28 beds (two pavilions, each for 12 beds, and one special building, four beds), all giving a cubic space of a little over 2,000 cubic feet per bed. In 1888 a Dœcker hut was erected, having a cubic space of 3,600 cubic feet, presumably for two patients. The total accommodation for infectious diseases amounted, therefore, at that time to 30 beds.*

At the date of the epidemic (May 1892) no increase had been made, and the provision for all classes of infectious cases was still 30 beds, as compared with an actual requirement of 64 beds, based on the actual needs of the borough (see p. 63).

Power to acquire land for extension of the infectious diseases hospital within two years after the passing of the Act, was provided for by section 84 of the Warrington Extension and Water Act, 1890 (August 14th).

Epidemic of Scarlatina Concurrent.

Scarlet fever epidemic.

Scarlet fever is endemic in Warrington, and an exacerbation of the disease was running concurrently with the small-pox epidemic. Altogether 510 cases were notified during the year 1892, and the medical officer of health informed me that the average number of scarlet fever patients in the hospital during the six months ending December 1892 was between 70 and 80,† (see also p. 62.)

The average annual death-rate from scarlet fever in Warrington for the 10 years prior to compulsory notification (1879, 0·7) was 1·22 per 1,000 of the population. The average death-rate for 10 years after that time (1879–1888) was 0·49 per 1,000 of the population, a reduction of 0·7 per thousand in the mean annual mortality of this disease since compulsory notification was introduced.

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* Report of medical officer of health for 1892.

† Dr. Thorne Thorne. Report of Medical Officer to the Local Government Board, on the use and influence of infectious hospitals, 1882, p. 273.

* A further description of the hospital will be found on p. 61.

† The following are the monthly admissions of scarlet fever cases to hospital:—50 in July, 48 in August, 58 in September 57 in October 28 in November, and 13 in December 1892.

EXPLANATORY AND SUMMARY OF CASES.

Explanatory.

The period of time dealt with is from May 10, 1892, when the first case occurred, to May 10, 1893, when the outbreak was apparently fading away.§

The dates in the following narrative have reference always to the appearance of the eruption, as being the most fixed and definite symptom of the disease, and one which is, generally, the starting point for prompt measures in dealing with that particular case. On the appearance of the eruption the patient's friends, however ignorant, know that something has happened, and the day of its occurrence is rarely forgotten by them. The doctor is probably then able to declare the nature of the disease; and then also the responsible authority is enabled to adopt means for the prevention of its spread.

In the following narrative of the epidemic the action taken by the local sanitary authority will be interpolated between the successive groups of cases and indicated by smaller type. A chronological order is adopted throughout.

The cases of small-pox have been numbered in order of notification, which does not, necessarily, correspond with order of date of attack. Those followed by a small "a" are unnotified cases.

Groups.

The wave-like occurrence of cases, characteristic of epidemic infectious diseases, was well marked in this outbreak. At first there were intervals between the waves, when no cases occurred; gradually these intervals shortened, and later on they disappeared. Towards the end they returned, and the waves became gradually lower. (Chart opposite.)

Thus do the cases divide themselves into groups, or batches, and it will be both scientific and convenient to deal with them in periods of time, in the natural groups thus formed.

Group A.	(May 10th to June 1st) - -	4 cases.
Group I.	(July 26th) - - - -	1 case.
Group II.	(August 16th to August 23rd) -	15 cases.
Group III.	(August 30th to September 13th) -	50 cases.
Group IV.	(September 18th to November 12th)	308 cases.
Group V.	(November 13th to December 10th)	102 cases.
Group VI.	(December 11th to May 10th) -	187 cases.

Total May 10th, 1892, to May 10th, 1893, 667 cases.

Summary of cases.

Altogether 667 cases* are known to have occurred between May 10th, 1892, and May 10th, 1893, in a population of 54,084. Thus, 1·233 per cent. of the inhabitants of all ages were attacked. Of these 667 cases, 329, or *49* per cent., were mild or modified; 160, or *24* per cent., were discrete; 178, or *27* per cent., were confluent, malignant, or hæmorrhagic; and 62, or *9* per cent., died.

The different types of the disease are defined on p. 23.

The accompanying chart shows in a graphic manner the weekly occurrence of cases and the different types during the whole year, May 10, 1892–93. Here also is a table (Table I.) showing the proportions of the different types and the case-mortality during different months of that year.

TABLE I.

Showing the Number of Cases, and the proportion of each type which occurred during successive periods of the year, May 10th, 1892–May 10th, 1893§ :—

—	Total No. of Cases.	Fatal Cases.		Confluent.		Discrete.		Mild.	
		No. of Cases.	Per-centages.	No. of Cases.	Per-centages.	No. of Cases.	Per-centages.	No. of Cases.	Per-centages.
May 10th to July 26th 1892.	5	1	*20*	1	*20*	3	*60*	1	*20*
Four weeks ending Sept. 10th, 1892.	56	4	*7*	13	*23*	12	*22*	31	*55*
Four weeks ending Oct. 8th, 1892.	104	8	*7*	25	*24*	29	*28*	50	*48*
Four weeks ending Nov. 5th, 1892.	125	16	*13*	39	*31*	23	*18*	63	*51*
Four weeks ending Dec. 3rd, 1892.	169	18	*10*	48	*28*	28	*17*	93	*55*
Four weeks ending Dec. 31st, 1892.	44	7	*16*	14	*32*	14	*34*	16	*34*
Four weeks ending Jan. 28tb, 1893.	37	0	*0*	6	*16*	15	*43*	16	*41*
Four weeks ending Feb. 25th, 1893.	29	4	*14*	7	*25*	8	*27*	14	*48*
Four weeks ending March 25th, 1893.	29	1	*1*	6	*21*	9	*31*	14	*48*
Four weeks ending April 22nd, 1893.	49	1	*1*	12	*25*	13	*28*	24	*47*
Three weeks ending May 10th, 1893.	20	2	*10*	7	*35*	6	*30*	7	*35*
	667	62†	*9*	178	*27*	160	*24*	329	*49*

Note.—The dates refer to the cases which developed the eruption during that period, and the proportion of the deaths and different types among the cases which *arose* during that period.

Thus it will be seen that the *fatality* was higher in the middle (December) than at either end (with the remarkable exception of January); and that it was higher at the beginning than at the end of the epidemic.

The *severity* of attack was also greater in the middle (December) than at either end. But it differs from the fatality in being rather higher at the end than at the beginning of the epidemic.

NARRATIVE.

PRELIMINARY LOCALISED OUTBREAK IN MAY, 1892.

Group A.

(May 10th to June 1st.)—4 cases.

May 10th, 1892.

At the little village of Clifton, near Brighouse, Yorkshire, in April 1892, one of the farm hands was laid up with what his doctor called "measles," but which by its effects was proved to be small-pox. He stopped at home for a few days, and then went about as usual. Shortly after this, the farmer (Case A.) and his family removed to Latchford, 2 miles out of Warrington, and a day or two after their arrival, he, the farmer (Case A.), his daughter (Case B.), and son (Case C.), all developed the rash of small-pox.

Notification was not compulsory in the rural sanitary district around Warrington,† and no provision was made for the isolation of small-pox cases; but after five days' delay (May 10th–15th) arrangements were made between the Rural and Urban Sanitary Authorities for their reception into the Borough Fever Hospital in the town of Warrington (May 15th). The only member of the family who escaped the disease was the farmer's wife, whose vaccination marks are inferior to those of any of the others.

These people, being newly arrived, *had no friends in or around Warrington*, and, though there was a delay in their removal, they were carefully quarantined and confined to their house. The house itself is almost surrounded by fields, and the only member of the family (the mother) who escaped infection went into hospital with the patients.

Their house and its contents were promptly disinfected, and the only case which resulted was one of the two men (Case D.) employed by the Corporation to effect the disinfection. He had not been re-vaccinated, and developed the rash of small-pox 16 days later (June 1st). *No other than these four cases occurred for nearly two months afterwards.*

Action Local Author May 18 1892.

On May 18th, 1892, the medical officer of health in his report to the sanitary authority urged, for a second time, the advisability of providing fever hospital accommodation in a more suitable position, as follows:—

> "Up to the present time we have been able to cope with introduced cases notified from the borough, but, as I pointed out in February 1889, there is very great danger in treating small-pox cases in close proximity with a populous neighbourhood as Aikin Street is, and two full wards of scarlet fever in our own grounds.

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* Excluding cases proved not to be small-pox and including unnotified cases.

† Notification was subsequently adopted by the Rural Sanitary Authority October 1st, 1892.

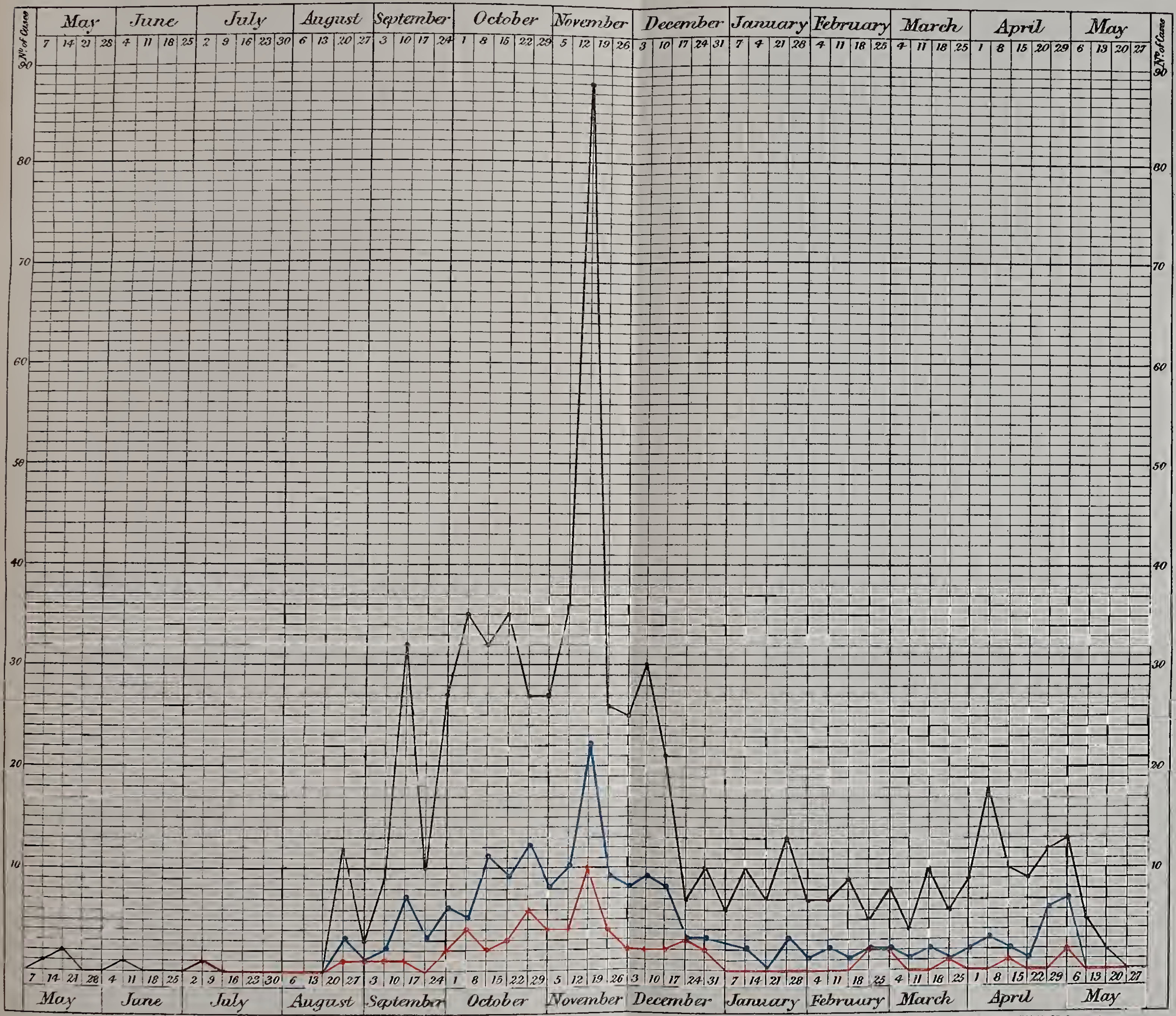
§ Since May 10th, 1893, up to the present time (December 1893), 24 cases have been notified as follows:—11 in May, 10 in June, 3 in July. None have been notified since July 24th, and the temporary hospital was closed on August 29th, 1893.

† This includes 4 vaccinated persons, whose proximate causes of death were, respectively: inflammation of lungs (607), pyæmia (117), nephritis (204), and phthisis (473); the small-pox being in them only a contributory cause of death.

CHART SHOWING THE NUMBER OF PERSONS WHO DEVELOPED THE ERUPTION OF SMALL-POX EACH WEEK ENDING WITH THE DATES GIVEN; THEIR TYPE, AND THE NUMBER OF THEM WHO SUBSEQUENTLY DIED. 10TH MAY 1892 TO 10TH MAY 1893.

MAY 1892.

MAY 1893.



Wyman & Sons, Ld, Lith, 63, Carter Lane.

To face page 8.

Explanation

Black = weekly number of persons who developed rash.

Blue = weekly no. of confluent cases.

Red = weekly number of deaths

"The experience gained by the Sheffield epidemic points to the fact that hospital accommodation, designed for the reception of small-pox, requires a much larger space about it than sites for other infectious diseases.

"It is nothing unusual for small-pox hospitals to disseminate the disease, and we run a considerable amount of risk in treating small-pox in the small ward (originally intended for the treatment of typhoid) near the administrative department, past which tradesmen and others are constantly passing, in addition to the nearness of adjoining streets and our own wards."

June 7th, 1892.

After having had the matter under consideration for some time the Town Council decided on June 7th to take preliminary steps for negotiation, with a view to purchase an acre of ground beside the old fever hospital (Aikin Street), as the time limit (2 years) provided in the Warrington Extension and Water Act, 1890, would shortly expire.

July 16th, 1892.

On July 16th the medical officer of health again, a third time, urged the desirability of more suitable provision for small-pox, and also called attention to the inadequate accommodation for scarlet fever.

The General Outbreak.

Group I.

(July 26th.)—1 case.

After an interval of nearly two months a navvy (W. R——, Case 1), residing at a common lodging-house in the centre of the town, was taken ill and kept to his bed. He developed a rash on July 26th, 1892. Two days later the owner of the lodging-house noticing the man, and not liking the appearance of the blotches on his face, boldly walked with him through some of the principal streets to a doctor, and thence to the Borough Fever Hospital. He was admitted (July 28th) and placed in the Dœcker tent, where he died eight days later (Aug. 5th). He had never been vaccinated.

The source of infection of this case is obscure. He was a labourer on the Manchester Ship Canal, two miles out of Warrington, not far from the house where the preliminary outbreak occurred in May. He came in each evening to the lodging-house. The owner of the lodging-house states that he had been residing there continuously for four weeks. Probably he incurred the disease from the ever-shifting population amongst whom he lived and worked.

The lodging-house was disinfected, and other precautions taken, and only one person (Case 4, whose rash appeared about August 17th), *so far as is known*, subsequently developed the disease among the 70 other inmates of this house, chiefly vagrants.

Patient's escape. July 30th, 1892.

Case 1 was a severe confluent one, and in his delirium he escaped from the hospital between 1 and 2 o'clock on Saturday morning, July 30th. The patient was at large in the town for some six or seven hours. Careful investigation has failed to discover exactly all he did during that time. He escaped by the main gate of the hospital, which he left open; visited the market, which is very busy on Saturday morning; was apprehended by a constable in Winwick Street, two-thirds of a mile away, and was conducted by him back to the hospital on foot about 8 a.m. through some of the busiest thoroughfares, where he probably came in contact with many foot passengers.

Consequences.

The consequences of this case appear to have been:—

1. Spread within the Borough Fever Hospital (p. 11).
2. Infection of, and spread within, the workhouse (p. 12).
3. Twelve other cases in different parts of the town, forming Group II. These will now be described.

Group II.

(August 16–23.)—15 cases.

A.—Details of the Individual Cases.

An interval of nearly three weeks separated the eruption of the first case from those of the second group of cases.

The 15 cases forming this group will merit careful individual study, and will be taken nearly *in the order in which they developed the eruption.* The numbers of the cases only indicate order of notification; the letter *a* after the number signifies that the case was unnotified. The positions of these cases may be seen in Map I.

Case 13.—Elizabeth S——, æt. 36, a vaccinated but not a re-vaccinated person, living in Howard Street, near the Old Fever Hospital, the mother in a household of 10, after ailing a few days, developed the rash of discrete small-pox on August 16th. Next day she sent for her doctor. Unfortunately, the doctor was away for a holiday, but *the assistant left in charge, who was alleged to be unqualified, called, and pronouncing the case to be "German measles," (although the spots are reported to have had "white heads to them,") treated the case at home as such for* 10 *days.* On August 25th the medical officer of health, hearing rumours of the case, visited her, and she was removed next day (August 26th) to hospital. But during that 10 days the visits of friends and neighbours were unrestricted; her husband and son went to work, and her seven other children were playing daily (for it was fine weather) with others in the open spaces, back and front, of the houses in that row. Three of her own well-vaccinated children (aged 14, 12, and 9) subsequently contracted the disease; and altogether, 23 cases* developed the eruption between August 30th and September 12th,† in the houses around the open spaces in front and rear of this house, and that of case 10.

These two open spaces lie within 150 yards radius of two supposed centres for the aërial spread of small-pox, the Borough Fever Hospital and the Workhouse, situated side by side, and in both of which small-pox patients were being collected. But it is a fashion among the artisan classes at Warrington for neighbours to spend much time in each other's houses, and for their children to play amidst the dirt of such open spaces (known as fields) as may be near (such as may be seen in photo. 3, p. 68), especially during the month of August, when the weather encourages outdoor life. Just such an open space is seen in photograph ——, beside the New Hospital to be spoken of hereafter.

August 17th.

Case 10.—Henry B——, æt. 10, living in the same street as the foregoing, was taken ill on the 14th, and developed the characteristic rash on August 17th. The same "doctor's assistant" as in the preceding case was at once sent for, and saw the boy. This time also the case was designated "German measles." The child was unvaccinated, and the case a severe confluent one, but it was not until the 23rd (on the seventh day of the rash) that it was recognised and removed to hospital, where the little boy died three days later. Meanwhile friends and neighbours visited the house freely, and the father, æt. 37, worked all the time at the Dallam and Bewsey forge, which takes so prominent a position in the future history of the epidemic. The father himself developed the rash 14 days after his son (although he was reported to have had small-pox 33 years before); and the barber, whom the "doctor" ordered to cut the hair, also took the disease. Three brothers and sisters, and the child's mother, all well vaccinated, escaped. Twenty-three cases resulted, as just mentioned, in the immediate neighbourhood of these two cases; and altogether 30 out of the 50 cases forming the next batch arose in this, the Whitecross, ward.

August 17th.

Case 6*a*.—Heywood H——, æt. 31, living in an adjacent street, a labourer at Richmond's gas stove works, developed a few spots on August 17th. He also was seen by the same "doctor's assistant" who attended the two foregoing cases. This case was a mild one, and entirely escaped detection or notification. The disease appeared in the wife 15 days afterwards (*Case* 17).

August 17th.

Case 6.—Mary T——, æt. 21, a dressmaker, developed the rash on August 17th. The case was a mild one, and the illness not regarded by the friends as sufficiently serious to need a doctor, until the 20th, when she was seen and promptly removed and isolated. This girl was at home four days with the eruption out. Unfortunately her aunt, with whom she lived, kept a small general provision store in a very populous part of the town; which, being a popular place of resort for the neighbouring housewives and workhouse inmates, was calculated to be a fruitful source of infection. Two weeks later, her aunt and her brother developed the rash in this same house.

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* Nos. 52, 19, 20, 26, 21, 18, 23, 25, 28, 69, 27, 29, 34, 35, 42, 54, 24, 56, 53, 62, 16, 22, 17.

† 14 and 17 days after August 16th and August 26th respectively.

August 18*th.* *Cases Nos.* 2 *and* 3.—Hettie L——, æt. 9, and Alice M——, æt. 25, developed the eruption on August 18th. They were, respectively, a scarlet fever patient and the kitchenmaid in the Old Borough Fever Hospital, and I am informed that they were therein isolated. Altogether 11 persons incurred infection within the Borough Fever Hospital—two officers, and nine scarlet fever patients (*see* p. 11).

August 18*th.* *Case* 7.—Richard D——, æt. 37, Liverpool Road, developed the eruption August 18th. The case was a confluent one, but it was mistaken by his doctor for scarlet fever, and notified as such until the 21st, when it was re-notified and removed. Unisolated for four days.

August 18*th.* *Case* 8.—Emanuel C——, æt. 16, an ironworker at the Bewsey Forge, living at Guardian Street, a mild case, developed the rash on August 18th. The illness was too trivial, he and his friends thought, to seek medical assistance until the 21st, when he was seen by a doctor, notified, and removed same day. At home four days with rash out.

August 18*th.* *Case* 9.—Mary B——, æt. 29, Haydock Street, was a confluent case. Rash appeared August 18th, but was not recognised by her doctor until the 23rd. At home six days with eruption out.

August 19*th.* *Case* 4.—David W——, æt. 34, a navvy, residing at the same lodging-house as the first case (Case 1), walked up by himself to the hospital with discrete small-pox out upon him on August 19th. The disease was there recognised and the patient admitted. The exact date when his eruption appeared is unknown; probably, the assistant medical officer of health thinks, about the 17th. He worked at some gasworks in the northern part of the town, but whether he attended there after the rash appeared is doubtful.

August 19*th.* *Case* 5.—Josiah A——, æt. 4, a mild case, developed the rash on August 19th. He was at the time an occupant of the girls' school in the workhouse adjacent to the fever hospital. A discussion thereupon ensued between the guardians and the borough sanitary authority as to whether the former ought to provide separate fever and small-pox accommodation for paupers. Meantime the case remained in the workhouse. Subsequently five cases arose in the workhouse by spread from this case (Nos. 44, 45, 56, 146, 213) (*see* p. 12).

Case 30*a*.—Agnes M——, æt 21, a servant at a much frequented public-house in Green Street, was a very mild case, and was never seen by a doctor at all. After ailing a few days, she developed one or two spots on August 20th, and was sent home a day or two later, to her mother, living in Cockhedge, a distant part of the town, where her sister developed the disease two weeks later, and several friends and relatives took the disease. Like Case 6 (Mary T——), this young woman lived at a popular place of resort. This case was never isolated at all. *Aug*

Case 12.—Jno. A——, æt. 31, Winwick Road, a severe confluent case, developed the eruption on August 22nd. The same "doctor's assistant," who attended the first three cases, declared this case not to be small-pox, but the mother, thinking otherwise, sent for another doctor, and the case was removed on the 24th. He died on the 30th. At home with the eruption out for three days. *Au* 22*n*

Case 11.—William B——, æt. 26, an ironworker at Dallam Forge, living in Winwick Street, developed the rash on August 23rd. The case was a mild one, but promptly recognised, and removed to hospital on August 24th. *Au* 23*r*

Case 15.—Thomas J——, æt. 44, Percy Street, brother of the landlord of the public-house where case 30*a* (*ante*) served, developed the eruption on August 23rd. The case, a discrete one, was seen by a doctor on the 24th, and notified on the 25th. *Aus* 23

But, unfortunately, the Borough Fever Hospital, where it was never possible to receive more than 13 cases at one time, was now quite full, and this man was, therefore, left at home altogether. This overcrowding of the Hospital was itself a source of danger to the inmates, as will be seen directly.

TABLE II.

GIVING some PARTICULARS of the 15 CASES forming GROUP II.

Case No. and Book Reference.	Name.	Age.	Address and District of Town.	Date of Rash.	Days Unisolated with the Rash out.	Type of Case.	Result (Recovery or Death).	Cause of delayed Removal to Hospital.	No. of other Cases which occurred in the same House as a Consequence.
13 $\frac{\text{VI.}}{15}$	S——, Elizabeth	36	Howard Street -	Aug. 16th	Eleven days -	Disc. -	R.	Non-recognition by doctor's assistant.	3
10 $\frac{\text{VI.}}{6}$	B——, Henry -	10	Howard Street -	Aug. 17th	Seven days -	Confl. -	D.	Non-recognition by doctor's assistant.	1
6*a* $\frac{\text{V.}}{2}$	H——, Haywood	31	Guardian Street -	Aug. 17th	Unnotified, never isolated.	Mild -	R.	Non-recognition by doctor's assistant.	1
6 $\frac{\text{V.}}{20}$	T——, Mary -	21	Priestly Street -	Aug. 17th	Four days - -	Mild -	R.	Did not send for doctor -	2
2 $\frac{\text{IV.}}{1}$	M——, Alice -	25	Kitchen - maid, Borough Fever Hospital.	Aug. 18th	0 days - -	Mild -	R.	In fever hospital - -	8 or 9
3 $\frac{\text{IV.}}{1}$	L——, Hettie	9	Borough Fever Hospital.	Aug. 18th	0 days - -	Mild -	R.	In fever hospital - -	
7 $\frac{\text{VII.}}{1}$	D——, Richard -	37	Liverpool Road -	Aug. 18th	Four days - -	Confl. -	R.	Mistaken by doctor for scarlet fever.	0
8 $\frac{\text{V.}}{1}$	C——, Emanuel	16	Guardian Street -	Aug. 18th	Four days - -	Mild -	R.	Did not send for a doctor -	0
9 $\frac{\text{VIII.}}{4}$	B——, Mary -	29	Haydock Street -	Aug. 18th	Six days - -	Confl. -	R.	Non-recognition by doctor	0
4 $\frac{\text{III.}}{1}$	W——, David -	36	A lodging-house on Friars Green whence R—— (Case 1) came.	Aug. 19th or 17th.	Unknown - -	Disc. -	R.	Walked up to hospital -	*Unknown.
5 $\frac{\text{V.}}{4}$	A——, Josiah -	4	Workhouse -	Aug. 19th	Never removed from workhouse.	Mild -	R.	Discussion between Guardians and Corporation.	5
30*a* $\frac{\text{VII.}}{11}$	M——, Agnes -	21	Green Street -	Aug. 20th	Never isolated -	Mild -	R.	Never seen by a doctor at all.	1
12 $\frac{\text{XI.}}{1}$	A——, John -	31	Winwick Road -	Aug. 22nd	Three days -	Confl. -	D.	Non-recognition by doctor's assistant.	0
11 $\frac{\text{II.}}{20}$	B——, William -	26	Winwick Street -	Aug. 23rd	Removed next day	Mild. -	R.	Not seen by a doctor before.	0
15 $\frac{\text{XII.}}{7}$	J——, Thomas -	44	Percy Street -	Aug. 23rd	Never removed to hospital.	Disc. -	R.	No room for reception into hospital.	0

* 70 or more vagrants and labourers shifting from day to day resided here.

Remarks on Table II.

From Table II. it will be seen that, if we exclude the two cases which occurred within the Borough Fever Hospital, there were only two out of the remaining 13 which were promptly recognised and removed. Of the remaining 11:—

1 case remained at home 10 days with the rash out.
1 " " 7 " "
1 " " 6 " "
3 cases " " 4 " "
1 case " " 3 " "
and four cases were never removed to hospital at all.

As regards the cause of delay in removal it will be observed that in four cases the patient or his friends did not consult a doctor immediately (Cases 6, 8, 4, 30*a*), and one of these was never seen or notified at all. Three of them were very mild cases, and the infections resulting from them were not, comparatively speaking, very numerous.

Four cases were seen and not recognised by the "doctor's assistant," acting in the absence of his principal (Cases 13, 10, 6*a*, 12), and one of these was never notified.

Two other cases were not recognised by their doctor;
Two cases were already in the Fever Hospital;
One was left in the workhouse; and
One had to be left at home because the hospital was full.

In all the cases removal was very prompt after notification, excepting in the last-named case.

B.—Source of Infection of 15 cases in Group II. (August 16–23.)

We have seen that the first case (R——) was for a long while the only known case in the town, that he was walked up to the hospital on July 28th, that he escaped on the 30th, and died on August 5th.

Now, the circumstances that all the cases of Group II. developed the disease within a few days of each other, and that this group was preceded and followed by quiet intervals without cases, render a common source of infection highly probable. And as R—— was the only known source at this time, it seems highly probable that he was, *directly or indirectly*, the cause of them all. Moreover, there are certain other facts which render it still more probable that he was the source.

1. The appearance of the eruption in all the cases in Group II. took place between 17 days after his escape from hospital, and 16 days after his death.

2. His excursion from the hospital must have brought him into direct contact with a large number of people, and although some of the cases of this group were scattered over the town, they all lived along, or adjacent to, the routes he is known to have traversed.

3. Even after death, R—— is accredited with spreading infection, for it was alleged that five of these cases contracted the disease from a man, who after assisting at his burial on August 5th spent the evening at an inn in the vicinity of Old Borough Hospital. One of these five was a servant there, and the other four were known to be regular frequenters of this inn.

But one of the officials of the hospital (the hospital keeper) was also a frequent visitor at this inn; and since the rash in these five cases appeared respectively on the 17th (H——), 18th (D——), 18th (C——), 20th (M——), 23rd (J——), of August, it seems less probable that they all took infection on the same day than on different occasions.

The incubation of the cases in this group may be thought long (as in Case D., p. 8), but 14 of these 15 early cases had ample opportunity of incurring infection, either directly from Case 1, or *through the mediation of a third person or object.*

It is of course possible that there existed other undiscovered cases as sources of infection to some of these 15, but no evidence of their existence was obtainable.

How the disease arose in the hospital (where two of these 15 early cases occurred), and the workhouse (where one occurred), and how it spread therein, will now be considered.

C.—Spread of Small-pox within the Old Borough Fever Hospital, Aikin Street.

How the disease spread here was a little difficult to investigate at the time I commenced this inquiry, December 1892, but the following facts are worthy of attention:—

R——, the navvy (Case 1), on his admission (July 28th) to the hospital, was placed in the Dœcker tent (marked k on plan, p. 61), where he died on August 5th. He was attended by a nurse who slept in the same structure, and subsequently, after his escape on July 30th, by a male attendant at night; both of whom gave evidence that he was delirious most of the time.

The persons who contracted the disease within the hospital were a kitchenmaid, a nurse in charge of the small-pox cases, and eight or nine scarlet fever patients; 10 or 11 persons in all (*vide* Table III. at foot of next page).

Position of cases and source of infection. August 18th.

The first person to contract the disease within the hospital was the kitchenmaid, Case 2 (who had not been re-vaccinated), who daily fetched and cleansed the plates and dishes used in the Dœcker tent. It was quite obvious that this and the next case took the disease from R——, Case 1.

On the same day a little scarlet fever patient, Case 3, who had been up and about, developed the disease. She was sleeping in the *acute* scarlet fever pavilion (a.a., hospital plan, p. 61) at that time, but soon after the appearance of the rash the child was *moved*, probably on account of the crowed state of the hospital, *over to the nurse's "duty room" in the centre of the* convalescent *scarlet fever pavilion (b.b.) opposite, in which all the cases but two subsequently arose.*

Cases which arose in pavilion a.a.

Only two cases (Cases 207 and 227*a*) subsequently occurred in pavilion a.a. Case 207 was a scarlet fever patient up and about. She may have contracted the disease either indirectly from Case 3, or from two young women suffering from small-pox, who were sent up by a doctor to the hospital as cases of scarlet fever, and taken straight into that pavilion; for there was no receiving or quarantine ward where patients could be placed pending the arrival of the medical officer of health. Or, again, she may have contracted it from Case 111, or Case 2.

Case 227*a* was a child who developed the rash on the 14th day in hospital. She was alleged to have incurred infection from the ambulance during removal to hospital, while suffering from scarletina.

Cases in pavilion b.b.

The remaining seven cases, which included the nurse of the pavilion b.b., arose among the patients in pavilion b.b. in succession, after Case 3 was sent over to the "duty room" there, and they were evidently traceable to that origin. Cases 55*a* and 60*a* were treated along with Case 3 in the nurses' duty room in the centre of that pavilion (b.b.) The later cases as they arose here were sent over to the "typhoid block" (c.c.), which was now being used temporarily for small-pox cases from outside.

It seems clear that R—— was a source of direct contagion to Cases 2 and 3; that Case 3 was a source of direct contagion to seven others in pavilion b.b., as represented in the annexed diagram. (Diagram I.)

Vaccinated condition.

It did not appear that the scarlet fever patients in hospital were re-vaccinated at the time of the outbreak of small-pox. The nine scarlet fever patients who contracted small-pox had never been vaccinated since infancy. Two of them were unvaccinated, and of these one died.

It was stated that all the Borough Fever Hospital staff were re-vaccinated in May, 1892, but the two above mentioned (viz., kitchen-maid, 2, and nurse, 111) had not been re-vaccinated.* They are stated to have joined after that date.

Proportion attacked.

The number of scarlet fever patients in hospital in August was about 75; the number admitted during September was 58, October 57, November 28; the officials numbered about 14; so that the number of persons exposed within the hospital during this time was 232 (chiefly children), of whom 11, or 4·7 per cent., took small-pox.

This does not include the two persons mentioned in the note at foot of Table III.

Causes of spread in hospital.

The proximate cause of the spread of small-pox within the Borough Fever (or Isolation) Hospital, Aikin Street, was undoubtedly insufficient isolation of R——, (Case 1), and of the other cases as they arose.

The task of isolation was rendered extremely difficult by reason of the insufficient accommodation provided by the Sanitary Authority, and the consequent overcrowding among the scarlet fever patients. This was the real source of all the mischief; but there are three other, contributory, causes,—

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* The nurse subsequently stated that she was re-vaccinated a few days before the eruption.

1. When the matron of a hospital is the chief resident official of a hospital, it is very desirable that she should be possessed of exceptional qualities for the post. I was informed that none of the nursing staff had had any previous hospital training or experience prior to their appointment at the Aikin Street Hospital. Though at the time of the outbreak the matron had held the post for five years previously.

2. The fact of there being no quarantine or receiving ward where patients could wait pending the arrival of the doctor, and pending diagnosis, is certainly a very serious defect in an isolation hospital. Two instances have been mentioned of the consequences arising therefrom.

3. In dealing with contributory causes some authorities would urge‡ that re-vaccination of all the scarlet fever patients and inspection of the entire staff at this time would have been a reasonable precaution.

The foregoing narrative sufficiently explains the serious spread of small-pox within the Fever Hospital without the intervention of the hypothesis of aërial convection (p. 66).

D.—Origin and Spread of Small-pox in the Warrington Workhouse.

The workhouse, like the hospital, was early invaded by the disease, and being only separated from the latter by a high wall, the incident possesses some interest.

Origi case. Aug. 1

The first person attacked was a little boy, Josiah A——, æt. 4 (Case 5), a permanent inmate of the girls' school, situated in a part of the building adjacent to, and only 120

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‡ Metropolitan Asylums' Board Report, 1891, pp. 61, 62.

Table III.

Particulars of 11 Cases, forming part of Groups II., III., and IV., arising among the Inmates of the Old Borough Fever Hospital.

Case No. and Book Refcrence	Name of Patient.	Sex.	Age.	Admission to Hospital.	Date of Rash.	Position in Hospital at Time of Infection.	Primary Vaccination.				Re-vaccination.
							Date.	Marks.			
								No.	Charac-ter.	Area.	
2 $\frac{\text{IV.}}{1}$	M——, Alice	F.	25	Kitchenmaid in hospital since May.	Aug. 18th	Administrative block	Infancy	2	W. fov.	II.	Never.
3 $\frac{\text{IV.}}{1}$	L——, Hettie*	F.	9	Aug. 2nd	Aug. 18th	Acute scarlet fever pavilion (a.a.), then put over in duty room of pavilion (b.b.).*	Infancy	1	Fov. cic.	III.	Never.
55a $\frac{\text{IV.}}{23}$	J——, Ada	F.	9	Aug. 12th	About Sept. 12th.	Convalescent scarlet fever pavilion (b.b.).	Infancy	1	Fov.	III.	Never.
60a $\frac{\text{IV.}}{24}$	O'D——, Jimmy	M.	10	Aug. 22nd	About Sept. 12th.	Convalescent scarlet fever pavilion (b.b.).	Infancy	3	Fov.	III.	Never.
111 $\frac{\text{IV.}}{1}$	R——, Mary	F.	24	Nurse in hospital.	Sept. 30th	On duty in convalescent scarlet fever pavilion (b.b.).	Infancy	1	Fov.	I.	A day or two before the eruption.
207 $\frac{\text{IV.}}{2}$	K——, Mary*	F.	25	Sept. 28th	Oct. 17th	Acute scarlet fever pavilion (a.a.), then sent over to duty room of pavilion (b.b.).*	Infancy	2	Plane marks.	IV.	Never.
227a $\frac{\text{IV.}}{1}$	C——, Elizabeth (contracted outside?).†	F.	13	Oct. 13th	Oct. 26th	Acute scarlet fever pavilion (a.a.), or ambulance.	Unvaccinated				—
281 $\frac{\text{VII.}}{15}$	W——, Alice	F.	7	September	Sent home Oct. 31st; rash, Nov. 3rd.	Convalescent scarlet fever pavilion (b.b.).	Infancy	3	Marks	—	Never.
302 $\frac{\text{XV.}}{1}$	M——, John	M.	11	September	Sent home Oct. 31st; rash, Nov. 7th.	Convalescent scarlet fever pavilion (b.b.).	Infancy	2	Marks	—	Never.
302a $\frac{\text{IV.}}{2}$	M——, Annie	F.	7	Sept. 23rd	Nov. 9th	Convalescent scarlet fever pavilion (b.b.).	Infancy	2	Plane	IV.	Never.
391 $\frac{\text{XV.}}{1}$	M——, Mary	F.	4	Sept. 8th	Nov. 11th	Convalescent scarlet fever pavilion (b.b.).	Unvaccinated				Died Nov. 30th.

* Consequent spread in convalescent scarlet fever pavilion (b.b.) from both of these cases.

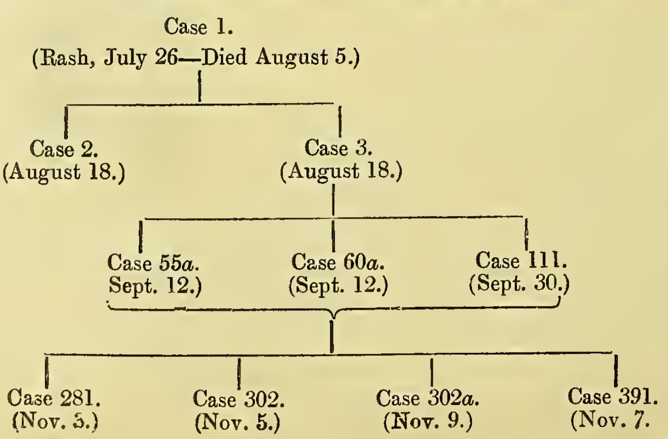
† The mother attributes the source of infection to her child being taken to the hospital in the same ambulance as a small-pox patient from same street 15 minutes before. The rash appeared 13 days afterwards.

Note.—Two of the above were unvaccinated (227a and 391), and none had been re-vaccinated; one of the two unvaccinated cases died. Eight of those attacked were under 14 years old, one was 24, and two 25.

Case 60, who attributes her infection to a visit to the fever hospital 14 days previously, is not included in this table. Nor does it include an unvaccinated child (Case 390), who was discharged from the scarlet fever ward November 7th, developed the rash of small-pox November 20th, and died November 28th.

Diagram I., showing Spread of Infection within the Borough Isolation Hospital, and giving dates of Eruption.

Case 207 and 227*a* are omitted, as there are alternative sources of infection.



yards from the Dœcker tent in the Hospital grounds where R—— was placed on July 28th, whence he escaped on July 30, and where he died on August 5th. J. A—— developed the rash on August 19th.

ource ection.

The source of his infection was a point of some difficulty, but the following facts merit consideration :—

1. Careful investigation showed that communication between the inmates and the officials of the two buildings was unlikely to have taken place.

2. The suggestion of aërial infection was favoured by the close proximity, but was rendered unlikely (1) in view of more probable explanations, and (2) by the fact that this (a well-vaccinated child of four years) was, as we shall see, *the only instance among all the cases which arose within the workhouse during the whole period of the epidemic where there was any doubt whatever as to direct infection.* There were on August 7th, 1892, 294 inmates and officials* residing in the workhouse, the main building of which is only 120 yards from the hospital, and the grounds of which are only separated from the hospital by a wall. If, therefore, the Hospital formed a centre for aërial convection, it is remarkable that all these persons should have escaped infection by this means.

3. Possibly infection was brought to him from the public-house already referred to (p. 11, para. 3) by some of the workhouse officials who were known to frequent it. August 5th would tally with his date of infection.

4. Possibly it was brought to him by some of the officials or inmates of the workhouse who frequently visited the little provision shop close to the workhouse, where Case 6 occurred (rash August 17th, p. 9.) R—— (the first case, Group I.) informed the constable who apprehended him that he had left the hospital to look for food. Would he not naturally enter a provision shop, which he must have passed at some time between 2 and 8 a m.? At any rate, it was obvious, from subsequent events, that both this shop and the public-house were centres of contagion.

5. Many visitors and fresh admissions of the vagrant class, came to the workhouse in the early days of August, not only from Warrington (from the first infected lodging-house and elsewhere), but also from more distant places infected with the disease.

6. Two children, named L——, were admitted on August 2nd, and placed in the same dormitory with little A——, who had been in constant communication with their cousins in Mill Street, who developed so-called "chicken-pox" about this time. Subsequently the father of these latter died of confluent small-pox (Case 377).

It seems, therefore, highly probable that the origin of the infection of the first case in the workhouse was one of the last four named possible sources of direct contagion, though which particular one was hard to decide at the time of my inquiry.

As the Urban Sanitary Authority refused to take little A—— into the Borough Fever Hospital, he was taken (Aug. 26) over to the "fever ward" attached to the workhouse, and an attendant told off to look after him.

Subsequent cases.

I am indebted to the matron of the workhouse for the following very lucid account of the subsequent spread of the disease within the workhouse; the accuracy of which I had ample opportunity of confirming. The cases form a series of direct contagions from the little boy J. A——.

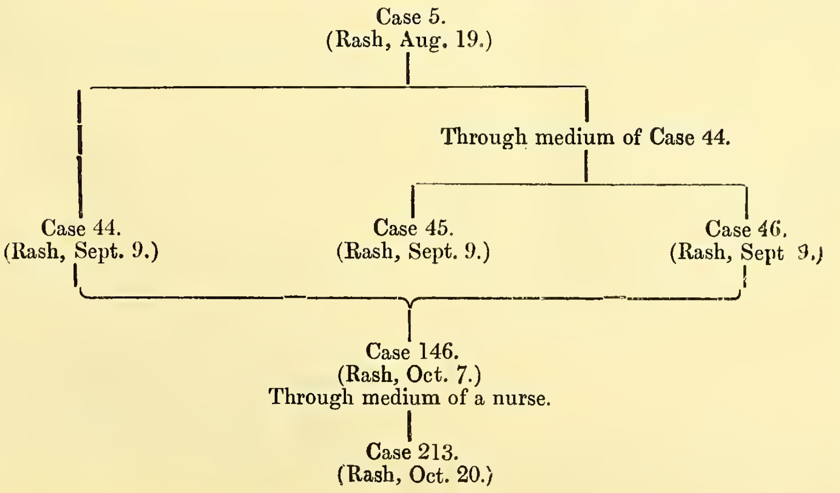
TABLE IV.

PARTICULARS of Six Cases, forming part of Groups II., III., and IV., arising among the inmates of Workhouse.

Case No. and Book Reference	Name of Patient.	Sex.	Age.	Date of Rash.	Position.	Type of Case.	Primary Vaccination.				Re-vaccination.
							Date.	No.	Character.	Area.	
5 $\frac{\text{V.}}{4}$	A——, Josiah -	M.	4	19th Aug. -	Infants' school - -	Mild - -	Infancy	1	Fov.cic.	II.	Never.
44 $\frac{\text{V.}}{4}$	K——, Alice -	F.	24	9th Sept. -	Nurse - - -	Mild - -	Infancy	2	Fov.cic. v. good marks.	I.	Never.
45 $\frac{\text{V.}}{4}$	C——, Mary -	F.	19	9th Sept. -	Female sick wards -	Disc. - -	Doubtful.				Never.
46 $\frac{\text{V.}}{4}$	R——, Matilda -	F.	19	9th Sept. -	Female sick wards -	Disc. - -	Infancy	Unknown.			Never
146 $\frac{\text{V.}}{4}$	R——, Geo. -	M.	61	7th Oct. - -	Male sick wards - -	Disc. - -	Infancy	1	Faint Fov.	IV.	Never.
213 $\frac{\text{V.}}{4}$	H——, P. -	M.	26	20th Oct. -	Male sick wards - -	Disc. - -	Infancy	2	Fov.	II.	Never.

DIAGRAM II.

SHOWING how INFECTION spread to Five Occupants of the Workhouse.



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* Infirm, 122; able-bodied, 107; persons under sixteen, 52; paid officials, 13; total, 294.

September 9th.

Second case (No. 44.), rash, Friday, September 9th, was a nurse, having good primary vaccination marks, but not re-vaccinated, who had carried little A—— over to the fever ward of the workhouse 14 days before, Friday, August 26th.

Third and fourth cases (Nos. 45 and 46) were inmates under the care of the nurse (Case 44). These two developed the eruption on the same day as the nurse, and were clear illustrations of conveyance of infection by a third person; who in this instance also contracted the disease herself.

October 7th.

Fifth case (No. 146, rash October 7th), contracted the disease from a nurse who now looked after the small-pox cases, to whom he went daily to have his leg dressed; another illustration of conveyance by a third person.

October 20th.

Sixth case (213), Philip H——, rash October 20th, contracted the disease by making the bed of Case 146, directly after the latter had been removed to the fever block of the Workhouse on October 7th.

Other cases.

Altogether 17 cases[*] were notified from the workhouse, but only these six contracted the disease within the building. All the others were brought in with the eruption on them, or developed it within a few days.

Procedure.

All leave of, and visitors to, officials and inmates, were stopped on August 20th. Measures of quarantine for fresh admissions were adopted (September 15th), and for the isolation of cases as they arose, were carried out as far as the resources of the workhouse would allow.

Re-vaccination.

During August all the officers were inspected and urged to be re-vaccinated, and many were done Some omitted or refused to be done, among whom was the nurse (Case 44).

Full particulars of the number of inmates re-vaccinated are given on p. 66, and it will be seen that only 59 were re-vaccinated prior to September 19th, when the small-pox cases were removed from the adjacent Fever Hospital to the temporary hospital in Dallam Lane.

Cause of spread in Workhouse.

Apart from the question of vaccination and re-vaccination, the cause of the spread of small-pox in the workhouse, as in the hospital, was deficient isolation. In all cases after the first, direct contagion could readily be traced. The remarkable absence of unexplained infections is commented on, on p. 66.

Up to October the workhouse had to provide accommodation for its own cases as they arose or were brought in. Afterwards the sanitary authority consented to receive them in the Temporary Hospital. Fresh admissions were often found to be infected with the disease, and had it not been for quarantine in the receiving ward, and good management, the disease must have spread.

It is, however, to the credit of the workhouse authorities that only six cases (·8 per cent.)[†] should have resulted among 712 inhabitants[‡] exposed in the workhouse, most of whom are of a low order of intelligence, and all dwelling in an institution neither designed by structure nor administration for the management and isolation of infectious disease.

E.—Other Consequences of Group II.

Factories.

It has been seen that as a consequence of the cases of Group II. the disease spread, (*a*) within the borough isolation hospital and (*b*) within the workhouse respectively. But infection was also carried to several different works and factories in the town:—

(*c*.) *Dallam and Bewsey Forge*, the chief ironworks of the town, employ over 2,000 hands. Here the son of Case 13, worked all the while (10 days) that the case was unrecognised and unisolated. Here also the father of Case 10 worked for seven days, during which his son's disease was unrecognised and unisolated. Cases 8 and 9 were themselves employed in these works, and so also was the brother of Case 6. Thus were there already five different sources of infection to the operatives in this forge, which plays, as we shall see, such an important part in the subsequent history of this epidemic, by its contiguity to the Temporary Small-pox Hospital. Altogether 83 cases occurred amongst the 2,075 employed in these works during the year May 1892 to May 1893. They will be considered in detail subsequently (pp. 44 and 75).

(*d*.) *A Fustian Cutting Shop* in Wakefield Street employing 100 hands also became infected. Here the sister of Case 8 (C——) worked during the three days he was at home and unisolated at a bench adjacent to the first girl attacked. The sister of Case 10 (B——) also worked here. Altogether 11 of the employés in this establishment were attacked.

(*e*.) *A Fustian Cutting Shop* in Aikin street was also early infected. 12 cases were taken in succession out of one of the rooms.

We have seen that in consequence of the delayed isolation of cases in Group II. the disease spread within the hospital, and within the workhouse, and that various works in the town became infected. Table II. (p. 10) shows, in the right hand column, that eight cases, besides the workhouse and hospital ones, occurred soon afterwards in the already infected houses of this group.

But the gross effect of Group II. was the production of a crop of 50 cases forming Group III., which will be dealt with next. And, beyond all doubt, the largest number of these fresh infections resulted from the cases seen by the doctor's assistant, who was acting in the absence of his principal. The evidence goes to show that three out of these four cases were extremely well-marked types of the affection. It is probable that the epidemic would have been stamped out at an earlier date if these four cases had been promptly recognised. It is certain that the epidemic, in that event, would never have reached the dimensions which it did.

On August 23rd, 1892, the Town Council wrote to the Local Government Board, reporting the outbreak of small-pox, asking consent to borrow 800*l.* under the Warrington Extension and Water Act, 1890, to purchase a *temporary structure* for the reception of small-pox cases.

September 5, 1892, Local Government Board stated they were unable to sanction a loan to provide *temporary* accommodation.

Group III.

(August 30th to September 13th.)—50 cases.

August 30th. Daily numbers.

After Group II. no fresh cases developed the rash for six days, but on August 30th three persons showed the eruption, two more on the next day, the daily number gradually increasing up to eight on September 9th, and then gradually subsiding to one on September 13th; 50 cases in all during the 15 days, August 30th to September 13th.

Sources of infection.

The cases of the dressmaker living at the provision shop in Priestly Street, and the servant at the public-house in Green Street, already alluded to, were sources of infection to some. But the great majority of this group of cases could be traced to the three cases attended by the doctor's assistant, two of which (13 and 10) were treated at home as German measles for ten and seven days respectively, whilst the third (6*a*) was out and about all the time.

Position of cases.

Concerning the position of these 50 cases, three were in the workhouse, two in the hospital, and no fewer than 30 lived in the neighbourhood of the three patients just mentioned, close by the Old Fever Hospital in Whitecross Ward. The remaining 15 were scattered in different parts of the town, but traceable in almost every instance to some communication, on pleasure or on business, with the people in the infected quarter, the southern part of Whitecross Ward.[*]

The largest number of small-pox cases which the Old Fever Hospital (Aikin Street) could receive was 13, and we have seen that this number was reached a week or more before this date, for the last Case in Group II. (Case 15, rash Aug. 23rd) was left in his own home on this account. What, therefore, was to be done with the 50 cases, Aug.

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[*] In addition to the six just mentioned, there were Nos. 32, 78, 206, 473, 474, 475, 487, 553, 557, 564, 610.

[†] As compared with 4·7 per cent. among the scarlet fever patients and officers in the Borough Fever Hospital.

[‡] Number of officers and inmates on August 7th, 1892, 294, add 66 fresh admissions per month (average) in August, September, October, November, and December, estimated at 352 = total, 713.

[*] The positions occupied by these 15 scattered cases, and the number of days spent at home with the rash out are as follows:—Golborne Street (15 days); Shepherds' Row (14 days); Dixon Street (never removed); Knutsford Road (never removed); Catherine Street (13 days); Winwick Street (admitted to and kept in workhouse); Church Street (7 days); two cases in Pierpoint Street (10 and 11 days respectively), where so many Dallam and Bewsey men lived; Hopwood street (never removed); Church Street (nine days); Latchford (10 days); Kendrick Street (unremoved); Cockhedge (9 days); Bewsey Road (unremoved).

30th to Sept. 13th? As beds became vacant, four of them were taken into the hospital, but—

26 of them were left at home for periods varying from 3 to 22 days with the eruption out.

14 others were never removed to hospital at all,*

4 remained in the Workhouse, and,

2 were already in the Hospital.

ember 892. tion to ospital.

On this date the Town Council, at their monthly meeting, empowered the medical officer of health and the borough surveyor to purchase a suitable structure for the reception of small-pox cases, which was to be erected on land that it was proposed to acquire, situated behind the Borough Fever Hospital, Aikin Street.

This land was finally, after two years' deliberation, bought by the Town Council at their meeting on October 4th.

Arrangements were made for a building of the same size as the existing pavilions, to be completed in 14 days. But by September 8th 38 cases had been notified, by September 10th 46 cases, by September 12th 53 cases, and it soon became obvious that it was too late to adopt such measures as these, and that far larger accommodation would be required.

As a matter of fact this building was never used for small-pox cases. Its completion did not take place until far into October, and was then made use of to relieve the overcrowded state of the other parts of the Old Fever Hospital with scarlet fever patients.

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The medical officer of health had at various times made suggestions, both before and after the commencement of the outbreak, as to certain desirablo procedures, but it was not until the meeting of the Town Council, on September 6th, that "the medical officer of "Health was empowered to do everything he might consider "necessary under the emergency."

September 19th, 1892. Opening of a new hospital.

On the representation of the medical officer of health the Sanitary Authority began, in the early part of September, to take steps to provide additional accommodation in the northern part of the town. Here some disused ironworks were converted into a temporary hospital, and opened for the reception of cases on Monday, September 19th, 1892.

The building was situated at the end of Dallam Lane, on the northern fringe of the inhabited part of the town, and it was known as the Dallam Lane, New, or Hope Hospital.

Sixty-four cases of small-pox were notified up to this time (September 19th), which was in many ways the most memorable date in the history of the outbreak, as will subsequently be seen.

11 cases in the old hospital were then removed to the new one; and the centre of infection seems also to have shifted about this time from Howard Street, beside the old hospital, to Dallam Lane and other streets near the new hospital. The causes of this transfer will be considered on p. 69 (Part II.).

Vaccination September 7th, 1892.

The ordinary arrangements for vaccination are that vaccinations are done once a week at one station in Golborne Street for the whole town.

On September 7th, 1892, in pursuance of a recommendation from the public vaccinator, the guardians arranged to open a special additional vaccination station, at Priestly Street in the infected district beside the Old Borough Fever Hospital, for four weeks, for the purpose of carrying out re-vaccinations one day per week.

Group IV.

(September 18th to November 12th.)—308 cases.

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There had been a lull in the cases during the week ended Sept. 17th, during the last five days of which only two cases occurred; and it seemed as though the consequences of the non-recognition and non-isolation of the earlier cases were dying away. But next week (ended Sept. 24th), 27 persons developed the rash; 35 the next (Oct. 1st), and the weekly figure varied between these numbers up to Nov. 5th. Finally, during the week ended Nov. 12th, 88 persons developed the eruption.

ce of tion.

Group IV. is clearly traceable to the cases left at home by reason of the lack of the hospital accommodation (Aug. 23), which was remedied by the temporary hospital on Sept. 19th. For two weeks (from about Sept. 5th to Sept. 19th), *i.e.*, until the opening of the New Temporary Hospital, there was no place to which cases as they arose could be removed; and we find on this date, Sept. 19th, that there were no fewer than 46 cases of small-pox which had remained in their own homes, after the appearance of the rash, for periods varying from 7 to 21 days, surrounded by ignorance, dirt, and in many cases destitution; for, as we shall see, all the infected houses in the Warrington epidemic, with few exceptions, belonged to the labouring and lower classes.†

ation.

As regards the situation of these 46 unisolated patients, 28 of them lived in the neighbourhood of the Old Fever Hospital (Whitecross Ward), near, and mostly in same street as S—— (13), H—— (6*a*), and B—— (10). The other 18 were scattered pretty evenly over the rest of the town.‡

tion.

Thus we see that there were on Sept. 19th 46 persons each capable of forming a centre for the spread of the disease, and it is not difficult to account for the continued increase in the number of cases. Eighteen of these 46 were never admitted to hospital at all; the others were, after Sept. 19th, removed as fast as accommodation could be provided in the New Hospital, but the resources of the town were taxed to the uttermost.

Climax week and its cause.

As to the cause of the excessive number during the week ended Nov. 12th, it may be seen, on referring to a period two weeks prior to this one, that between October 14th and October 26th there were 25 cases* of delayed removal for varying periods of time from 3 to 14 days after the rash appeared, and five others were never removed at all. It will be a matter for subsequent consideration (p. 69) how far, and in what manner, the New Hospital itself acted at this time (Oct. 26th) as a means of spreading the disease, for many cases arose around it. 36 of these 88 cases arose among the Dallam and Bewsey forgemen, the cause of which is referred to on p. 75.

At this point (Nov. 12th) the epidemic reached its climax. Hereafter we only have to consider the continuance (Group V.), and the decline (Group VI.) of the epidemic.

Change of infection centre. October 1892.

As regards the position of the earlier group of cases we saw that they arose largely beside the Old Fever Hospital, that is among the inhabitants of Howard Street, where S——, H——, and B—— (p. 9, *ante*) lived. But in October and November the centre of infection seems to have been changed to the northern end of Dallam Lane, Stamford Street, Pierpoint Street, and Winwick Road, streets in the neighbourhood of the New Hospital.

It will subsequently be seen (pp. 67 and 68) that the arrangements for enclosing this New or Temporary Hospital, and cutting off communications, were very imperfect, and that this establishment itself constituted a prolific source of infection to the inhabitants of the town in general, and those living near in particular.

September 21st, 1892. Quarantine at workhouse.

On September 21st, 1892, the Guardians decided to establish 14 days' quarantine for all fresh admissions to the workhouse, the workhouse board-room to be converted to that purpose.

September 24th, 1892. Appointment of assistant medical officer of health.

Mr. J. Guest Gornall, M.B., M.A., was appointed by the Health Committee to assist his father, the medical officer of health, and he took up the duties of medical officer at the New Hospital on October 4th. He resided at the Old Hospital like the rest of the staff of the New Hospital, and, like them, came backwards and forwards daily until November 9th, when sleeping provision was made for them at the new building.

October 25th.

Dallam Lane, beside the New Hospital, was ordered by the Town Council to be barricaded.

November 8th 1892.

The town clerk wrote to the Local Government Board stating that 30 cases of small-pox had been reported in the preceding

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* The numbers and positions of these 14 *unremoved* cases are as follows:—No. 19, in Howard Street, No. 23, in Howard Street, No. 28, in Howard Street, No. 29, in Howard Street, No. 33, in Dixon Street, No. 36, in Knutsford Road, No. 24, in Wakefield Street, No. 39, in Bostock Street, No. 56, in Wakefield Street, No. 58, in Hopwood Street, No. 47, in Selby Street, No. 59, in Kendrick Street, No. 48, in Bricrly Street, No. 55, in Bewsey Road.

† Numbers of the 46 cases unisolated on Sept. 19th:—14, 15, 18, 19, 20, 23, 24, 25, 26, 27, 28, 29, 30, 30*a*, 31, 32, 33, 34, 35, 36, 37, 38, 39, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, and 64.

‡ Cases of delayed removal scattered over the town on Sept. 19th, not in the Whitecross Ward. The numbers in brackets signify the days spent at home with rash out. 31 (15), 30 (14), 37 (13), 40 (7), 43 (11), 49 (10), 50 (9), 51 (10), 57 (9); and nine were never taken to hospital at all, viz., Nos. 33, 36, 32, 44, 45, 46, 58, 59, 55.

* Numbers 182, 188, 224, 183, 184, 185, 189, 212, 193, 194, 196, 197, 203, 235, 198, 204, 205, 209, 211, 214, 220, 228, 229, 232, and 234. Five others were never removed at all, Numbers 173, 186, 190, 213, 260.

Assistance sought from Local Government Board.

24 hours, and asking that Board *to make regulations* under the Epidemic and Other Diseases Prevention Act, 1883, to enable the Corporation to cope with the epidemic by means of house-to-house visitation, and the compulsory isolation of patients and of persons who had been in contact with them.*

November 11th.

The Local Government Board declined to accede to this request; but a few days later an inspector of the Board (Dr. T. W. Thompson) was sent to Warrington, who recommended the Sanitary Authority to adopt measures—(1.) For increased accommodation of small-pox patients away from inhabited dwellings; (2.) For additions to the staff of inspectors of nuisances; (3.) For increasing the scavenging staff; (4.) For promoting facilities for vaccination and re-vaccination. These were carried out on Nov. 16, as mentioned below.

Group V.

(November 13th to December 10th.)—102 cases.

Weekly numbers.

After the climax week (November 12) we find that the weekly number only dropped to about where it had been before. 26, 25, 30, 21 persons developed the rash in the four succeeding weeks respectively.

Source of infection of Group V. Second hospital breakdown.

The fact that 88 persons developed the rash during the week ended November 12th has been mentioned. This figure, added to the 131 cases already in hospital at the commencement of that week, makes a total of 219 cases to be dealt with on the date named. But, even with the additional accommodation provided, it was impossible to find room for all the cases which arose during this week, and thus *a second deficiency* in the hospital accommodation took place. Fifty-nine of the 88 persons attacked during the climax week lacked prompt removal, being at home three or more days with the rash out, chiefly for want of room in the New Hospital. Hence the weekly numbers during the four weeks now under consideration (November 13 to December 10) only dropped back to their former position, albeit the means of recognition (by experience), notification, and removal were gradually becoming more perfect.

On November 2nd the public vaccinator asked the guardians to be enabled to vaccinate upon an additional day each week, but the guardians refused permission.

On November 16th, in pursuance of recommendations from Dr. Thompson, one of the Inspectors of the Local Government Board, THE GUARDIANS afforded increased facilities for re-vaccination, (1) by opening the public vaccination station on an additional afternoon and an evening each week; and (2) by appointing two assistants to the vaccination officer for house-to-house visitation. All to remain in force for six months.

In pursuance of resolutions adopted at a meeting of the medical men in Warrington, the TOWN COUNCIL empowered the medical officer of health to establish five stations for gratuitous vaccination in the borough, and to secure the services of five medical practitioners to perform vaccination.

Placards urging the inhabitants to be re-vaccinated were posted over the town.

During the later part of November and early part of December large numbers of people flocked to the vaccination stations, now seven in number, to be re-vaccinated.

Group VI.

(December 11th to May 10th.)—187 cases.

December 11th.

But why pursue the narrative further? Up to December 10th 460 cases had been notified. The houses, shops, inns, and other places of public resort in the town were by this time pervaded with the poison. On the other hand the inhabitants were now more on the look-out for the disease,† were more fully alive to its contagious and fatal nature, and were now doing their best, in their own simple way, to co-operate with the authorities to check its spread by avoiding contagion and getting re-vaccinated; the doctors by experience were more ready to recognise its earliest manifestations; and lastly, the authorities, now aroused, were able to cope with the more moderate number of fresh cases. We may perhaps also assume that the number of susceptible people was daily lessening?

It is estimated by the Medical Officer of Health that over one-third of the population had been re-vaccinated by the middle of December.

Taking always the persons who developed the eruptions during the week, the weekly numbers dropped on December 17th to 7, and ensuing weeks to 10, 6, 7, &c. (*vide* Chart, p. 8).

The average number of cases per week from December 11 to May 10th was eight. Once only was there any marked deviation above this, during the week ended April 1st, when 18 cases developed the rash. If we examine the nine cases which developed the rash on the 10 days ended March 19th, *i.e.*, two weeks before, we find that three of those nine cases remained at home with the eruption out for four, six, and five days respectively. Then the weekly numbers dropped again.

Throughout the epidemic the daily and weekly number of cases preserved the usual wave-like character. Finally, the numbers became less and less, gradually but irregularly, like the waves of a receding tide.

Summary.

CHRONOLOGICAL SUMMARY of action of LOCAL SANITARY AUTHORITY, and of CENTRAL AUTHORITY, as regards HOSPITAL PROVISION.

1881.—Borough Infectious Diseases Hospital (Aikin Street) provided with 28 beds.

1888.—Dœcker Tent (two beds) added. Total 30 beds, or one bed for every 1,800 inhabitants in 1892.

AUGUST 1890.—Provision made for enlargement of existing hospital for infectious disease in the Warrington Extension and Water Act, 1890.

MAY 1892.—Medical Officer of Health urges, for a second time, the need for better provision for small-pox and fever.

JUNE 1892.—Town Council decide to negotiate for one acre of ground near the Old Borough Fever Hospital, as the time limit of two years provided in the Act of 1890 will shortly expire.

JULY 1892.—Medical Officer of Health again presses, pointing out that accommodation is inadequate even for scarlet fever.

AUG. 23, 1892.—Town Council ask Local Government Board to sanction loan of 800*l.* to provide *temporary* small-pox accommodation.

AUG. 26, 1892.—Doecker Hut accidentally burnt down.

SEPT. 19th, 1892.—Opening of the disused ironworks for reception of small-pox cases. (Temporary or Hope Hospital in Dallam Lane.)

NOV. 8th, 1892.—Corporation ask the Local Government Board to make special regulations (under Act of 1883) to enable them to cope with epidemic.

NOV. 11th, 1892.—Local Government Board inspector visits the town and recommends Corporation to provide further accommodation for small-pox, removed as far as possible from inhabited dwellings.

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* The Act of 1883 only confers *borrowing* powers. Application had not been made under Section 134, Public Health Act, 1875, which confers powers on the Local Government Board to make *Regulations* in time of danger as regards England.

† Many cases were detected and notified to the medical officer of health by the relatives of the patients.

Chronological Summary of the provision for Vaccination and Re-vaccination.

January 10th, 1872, a Vaccination Officer was for the first time appointed in Warrington (under Act of 1871).

The population a well-vaccinated one in 1892.

Usual arrangements for vaccination :—The public vaccinator attends once a week in the afternoon. (Golborne Street.)

Sept. 7th, 1892.—Special vaccination station opened one afternoon a week in the infected district for four weeks. (Priestley Street.)

Nov. 2nd, 1892.—Guardians refuse to open the public vaccination station on an additional day each week.

Nov. 16th, 1892.—Guardians, on suggestion of Local Government Board inspector, open public vaccination station on an additional afternoon and one evening each week; and appoint two assistants to vaccination officer for house-to-house inquiry.

Dec. 6th, 1892.—On the recommendation of the medical profession in the town, the Town Council establish five free vaccination stations.

Further detail will be found in the foregoing narrative and also in Part II. of this report.

Summary of Narrative.

In conclusion, as regards the Warrington epidemic of small-pox, 1892–93, it may be gathered from the foregoing narrative :—

First. That the preliminary outbreak in May 1892 (consisting of three imported cases, and one secondary case), was effectually dealt with by isolation, disinfection, and quarantine; the only secondary case being a man employed in the necessary procedures.

Secondly. That after an interval of two months a navvy of the wandering class, living at a common lodging-house, was brought to the hospital with the disease. The source of his infection is unknown.

Thirdly. That the 15 cases forming Group II. arose by infection, directly or indirectly, from the navvy, who, from one cause or another, at different times, was not sufficiently isolated.

Fourthly. That the spread within the Fever Hospital was due to insufficient isolation of the earlier cases, owing chiefly to its overcrowded state; and possibly also, non-vaccination and non-re-vaccination of the inmates.

Fifthly. That the spread within the Workhouse was due to insufficient isolation of the first case therein.

Sixthly. That the 50 cases forming Group III. were traceable to infection from cases in Group II. owing to their insufficient isolation; and that the major portion of these 50 cases arose among persons in communication with the three cases seen but not recognised by a doctor's assistant.

Seventhly. That Group IV. (308 cases) arose in consequence of the non-isolation of cases in Group III., owing to lack of accommodation in the Old Borough Fever Hospital situated in Aikin Street.

Eighthly. That Group V. (102 cases) similarly arose from persons in Group IV. insufficiently or not promptly isolated, because, for a second time, the limit of hospital accommodation had been reached, although in the interval an additional structure had been temporarily converted into a hospital for isolation purposes—the Temporary or Hope Hospital in Dallam Lane.

Ninthly. That the disease gradually declined as re-vaccination became more general and as the means of coping with the epidemic became more perfect.*

Conclusion.

It will be gathered from the foregoing narrative that insufficient or imperfect isolation was an extremely important factor in the causation of the Warrington small-pox epidemic 1892–3. This was owing, in some instances at the commencement, to the non-recognition of certain cases by a doctor's assistant; but it was also due in a much larger degree to an absence of ordinary hospital accommodation for the reception and isolation of the patients as soon as they were attacked and identified.

The sanitary authority had neglected to act on the recommendations of their medical officer of health in this matter of hospital provision. The purchase of additional land for that purpose was contemplated in the summer of 1890, but it was not carried out until October 1892.

It is rendered evident from a close examination of the facts of the epidemic that if the town of Warrington had possessed adequate hospital accommodation for infectious disease the epidemic would probably never have reached the dimensions it did, and the disease would, in all probability, have been limited to a few cases in certain quarters of the town.

After a statement on the cost of the epidemic, the important subject of Vaccination, which has been investigated in some detail, will be considered, and will occupy the whole of Part II.

In Part III. of this Report the question of Isolation will be considered more in detail under five heads :—

1. Removal of case to hospital;
2. Quarantine (isolation) of relatives and friends;
3. Hospital accommodation;
4. Hospital administration;
5. Position of hospital; and Aërial Spread,

together with the subjects of Recognition of the disease, Notification, Disinfection, and other preventive measures specially applicable to small-pox.

Part IV. will be occupied with General Hygienic and Social questions.

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* Since May 10th, 1893, up to the present time (December 1893) 24 cases have been notified as follows: 11 in May, 10 in June, 3 in July. None have been notified since July 24th, and the temporary hospital was closed on August 29, 1893.

COST OF THE WARRINGTON EPIDEMIC 1892–93.

Explanatory.

It is somewhat difficult to gauge the cost of an epidemic. But an attempt will be made to deal with the subject under the following heads:—

(*a.*) Expenses incurred by the corporation in connexion with the Old Fever Hospital (Aikin Street) - - - - -	£882
(*b.*) Monetary cost in connexion with the Temporary Hospital provision - - -	£7,160
(*c.*) Expenses incurred by the corporation in making special provision for vaccination -	£90
(*d.*) Expenditure incurred by the guardians in respect of vaccination, out-relief, or hospital maintenance - - - - -	£603
(*e.*) Damage to trade.	
(*f.*) Sick clubs.	
(*g.*) Social and other consequences.	

(*a*).—ACTUAL EXPENSES incurred by the CORPORATION in connexion with the OLD BOROUGH FEVER HOSPITAL (AIKIN STREET) including REMOVALS, COMPENSATIONS, and NOTIFICATION FEES.*

	£	*s.*	*d.*
Salaries of staff - - - -	636	3	6
Notification fees (other than small pox) - - - - -	57	2	6
Medical and surgical appliances and disinfectants - -	158	19	1
Coal, gas, water, and taxes -	337	11	11
Provisions - - - -	758	18	8
†New disinfector and fitting -	361	8	4
†Costs for land beside old hospital	821	13	9
†New pavilion and repairs to old buildings - - - -	997	13	6
Other establishment expenses, including removals - -	415	3	10
Total - -	4,544	15	1
The estimated expenditure on this account for the year ended March 25, 1893, was 1,047*l.* 12*s.* Owing to the scarlet fever epidemic this would probably have been nearly doubled, therefore deduct - - - -	2,000	0	0
Balance - - -	2,544	15	1

† The whole of the first two of these items and part of the third should not altogether be charged to the small-pox epidemic, therefore a further deduction might be made of 1,662*l.*, leaving finally **882*l.* as chargeable to small-pox.** This method of exclusion is the only way to arrive at the cost incurred through small-pox in the Old Hospital.

(*b.*)—EXPENDITURE incurred by the CORPORATION in connexion with the NEW or TEMPORARY HOSPITAL, including REMOVALS, COMPENSATIONS, and SMALL-POX NOTIFICATION FEES.‡

	£	*s.*	*d.*
Salaries of staff - - -	699	18	0
Medical and surgical appliances and stimulants - - -	168	3	0
Temporary buildings, &c. -	849	8	11
Rent, rates, and taxes - -	175	13	0
Furnishing account - -	1,102	17	6
Provisions account - -	1,116	9	10
Other establishment expenses, including compensations (20*l.* 14*s.*) and removals - - -	247	13	7
Fees for notification - -	50	2	6
	4,410	6	4
Add to this the further expenditure as estimated by the borough treasurer from March 25th to August 1893 - - -	2,750	0	0
Total - -	7,160	6	4

(*c.*)—EXPENSES incurred by the CORPORATION in respect of special provision for VACCINATION and RE-VACCINATION.*

	£	*s.*	*d.*
Fees to medical men - -	60	18	0
Purchase of lymph - - -	26	2	0
Hire of stations - - -	3	0	0
Total - - -	90	0	0

(*d.*)—EXPENDITURE incurred by the GUARDIANS.†

	£	*s.*	*d.*
1. Additional vaccination, about -	103	0	0
2. Out-relief caused by members of families being in hospital or prohibited from work, about -	100	0	0
3. Expenses incurred by the guardians, as rural sanitary authority in providing hospital treatment for persons suffering from small-pox - - -	400	0	0
Total (equal to a penny rate on the whole rural district) -	603	0	0

TOTAL COST, AND HOW MET.

It will be seen that the total cost incurred by the town council was £8,132. This will be charged on the "improvement rate." It has already necessitated an increase in the rate of 1893 of 8*d.* in the £ and it will necessitate a further increase of 5*d.* in the £ which will probably be charged to 1894. Thus the sum of £8,132 has involved a special small-pox rate of 13*d.* in the £ on the rateable value of the borough.

The cost to the guardians amounts to about 600*l.*, and this the clerk states is equivalent to an increase of a 1*d.* rate on the whole rural sanitary district.

THE EXPENSE OF PANIC.

The average cost to the rates of 1,165 small-pox cases in different parts of the United Kingdom during the past few years amounts to £8 11*s.* per case (*British Medical Journal*, May 23, 1893). In the Warrington epidemic, 1892–3, there were altogether 667 + 24 = 691 cases, and these should not, therefore, have cost the rates more than a total of £5,908 1*s.* But we have seen that these cost £8,132, or £2,224 too much, and this additional expenditure was undoubtedly due to the authorities having delayed action until they were actually in presence of an epidemic.

(*e.*)—DAMAGE TO TRADE.

The following may be taken as examples:—A leading draper in the town writes, in answer to inquiries, that the firm has certainly lost in actual money 500*l.* by reason of the small-pox epidemic, during the six months ending March 25th, 1893.

The principal jeweller in the town writes that the profits of the firm for the year ending March 25th, 1893, when compared with those of the preceding year, show a decrease of 400*l.*

One of the chief corn and flour dealers in the town reports that his gross receipts for the six months ending March 25th, 1893, were 900*l.* less than in the corresponding period ending March 25, 1892; he also adds "We had a number of accounts closed by customers "living outside the town, which we have not yet succeeded in getting back."

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* Extracted from the borough treasurer's report for the year ended March 25th, 1893.

† From the borough treasurer's report for the year ended March 25th

* Extracted from the borough treasurer's report for the year ended March 25th, 1893.

The leading butcher in the town writes that his gross receipts for the six months ending March 25th, 1893, were 1,000*l.* less than during the corresponding period ending March 25th, 1892.

The excise officer reports a difference of 2,275 quarters of corn during the 12 months ending March 25th, 1893 (12 months ending March 25th, 1892, 5,514, 12 months ending March 25th, 1893, 3,239).

Expenditure by employers of labour in providing *gratuitous vaccination* for their employés, estimated at not less than 150*l.*

(*f.*)—Sick Clubs.

k Clubs.

Of course the sick clubs were affected to some extent, but not so much as one would expect, since the disease affected the indolent, ignorant, and non-saving classes more than those who belong to sick clubs.

I am indebted to the various secretaries for the following returns which show the cost incurred by the respective societies on account of small-pox.

They chiefly consist of sums paid to members out of work through the disease.

	£	s.	d.
Order of Foresters - - -	18	10	0
Order of Gardeners- - -	21	6	0
Order of Druids - - -	27	14	2
Order of Shepherds - -	74	0	0
Total - -	£141	10	2

There were no special small-pox associations started.

(*g.*)—Social and other Consequences.

nic.

Meetings and social gatherings of all sorts were of course at a standstill, and entertainments which had been previously arranged had to be postponed or abandoned at a heavy financial loss to their organisers.

Indeed, the acts of the Town Council and the other authorities were but imperfect indications of the panic which at one time (especially in November and December) existed among the townsfolk, and their earnest desire to be rid of the insidious and fatal foe.

Deaths.

Among the sixty-two persons who were certified to have died of small-pox between May 10th, 1892, and May 10th, 1893, forty-one were over 21 years of age, and thirty-four of these were married men or women, very nearly all of whom left families motherless or fatherless.*

Wages.

The loss of wages by sufferers from the disease, and by others who were debarred from following their employment, was one of the serious losses due to the epidemic. The disfigurement for life, which followed in some cases, should also be borne in mind in this connexion.

Misery.

But no figures can adequately gauge the misery, and often the destitution and degradation, into which whole families have been plunged by the illness, and sometimes death of their relatives; nor can figures, even were they forthcoming, accurately express the far-reaching mischief and inconvenience caused to the manufacturer, the worker, and to all classes of the community.

Estimated cost of the Warrington Small-pox epidemic of 1892–3 to the community.

	£	s.	d.
Expenditure of the various authorities as above mentioned - - -	8,735	0	0
Cost to employers of providing re-vaccination for their work-people (estimate)	150	0	0
Loss of wages of persons who contracted small-pox and of their friends at the time of quarantine (estimate) - -	500	0	0
Funeral expenses of persons who died from small-pox (estimate) - -	124	0	0
Cost to the parish authorities, sick clubs and others, of providing relief during and after the epidemic to those affected (estimate) - - - -	500	0	0
Probable value as wage-earners to the community of persons who died from small-pox (estimate) - - -	6,820	0	0
Cost to the sick clubs during the epidemic, and to the parish authorities, sick clubs and others of providing relief *after the epidemic* to those affected (estimate) -	250	0	0
Damage to trade (estimate) - -	5,000	0	0
Total - -	£22,079	0	0

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* Out of the remaining 10, 4 were unmarried and of 6 no social particulars could be obtained.

PART II.

The relations of Vaccination and Revaccination to the Small-Pox Epidemic in Warrington, 1892-3.

(Charts showing summaries of results, see end of this Part, p. 54.)

Division of the subject.

The evidence concerning Vaccination will be arranged in twelve sections :—

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Section B.—Methods of this inquiry - - - - - - - - - 22
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SECTION A.—ARRANGEMENTS FOR PUBLIC VACCINATION AND REVACCINATION IN THE BOROUGH OF WARRINGTON.

Ordinary provision by Guardians.

The Board of Guardians is, as usual, the authority responsible for the administration of the vaccination laws within the Warrington Union. The Union includes, but is more extensive than, the Borough, having in 1891, a population of 84,922 and an acreage of 31,168, as compared with 52,743, and an acreage of 1,968 in the Borough.*

But as regards the Borough, the ordinary provision for vaccination consists of one vaccination station in Golborne Street, where the Public Vaccinator (Mr. John H. Gornall, the Medical Officer of Health) attends one afternoon each week, the Vaccination Officer being Mr. Geo. Holford. The vaccinations in the Warrington Workhouse are done by the Medical Officer (Mr. C. N. Spinks).

Extra-ordinary provision by Guardians.

On September 7th, 1892, in pursuance of a recommendation from the Public Vaccinator, the Guardians arranged to open a special additional vaccination station at Priestly Street, in the infected district, one day a week for four weeks.

On November 2, 1892, the Guardians declined to open the public vaccination station in Golborne Street on an additional day each week.

On November 16, in pursuance of recommendations from Dr. Thompson, one of the Inspectors of the Local Government Board, the Guardians afforded increased facilities for revaccination, (1) by opening the public vaccination station on an additional afternoon and one evening each week; and (2) by appointing two assistants to the Vaccination Officer for house-to-house visitation. All to remain in force for six months.

Extra-ordinary provision by Town Council.

On December 6, 1892, in pursuance of resolutions adopted at a meeting of the medical men in Warrington, the Town Council empowered the Medical Officer of Health to establish five station for gratuitous vaccination in the borough, and to secure the services of five medical practitioners to perform vaccination.

Provisio for vacc tion ma by em- ployers labour.

The Dallam and Bewsy forge hands, numbering 2,075 men and boys, were early involved in the epidemic, and one of the mills was at one time on the point of being stopped. There was at first some apathy and opposition on the part of these workmen to the practice of vaccination; they could not be persuaded of the necessity. However. the Sick Fund Committee of the Works, *i.e.*, a committee of the men's representatives, acting on the suggestion of Mr. T. Morris, the manager, and Dr. Adams, the medical officer of the works, passed the following resolution on November 12, 1892 :—

"That any member who remains unrevaccinated after " Monday, November 21st, 1892, shall not be entitled to " any sick benefit should he be afflicted with small-pox." The expense of revaccination was borne by the sick fund.

Dr. Adams states that, as a consequence of this, between 1,400 and 1,500 hands were revaccinated during the last two weeks of November, and a good many others were done by their private doctors.

The fall in the number of cases of small-pox occurring among these workpeople after this date is referred to on pp. 44 and 75, *post*.

Most of the other employers in the town took steps during November to persuade their hands to be revaccinated either by offering it free of expense (*e.g.*, Longford Wire Works, Walker's Brewery, Tanner's Lane Tanning Co., Armitage and Rigby, Platt's Fustian Cutting Shops, and Whitecross Wire Works), or, by threatening dismissal. A table showing the incidence of small-pox in the different works will be found in Part IV. (p. 85, *post*).

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* *See* Part IV., p. 82.

Form of House-to-House Visiting Book used in this Inquiry.

Address ____________.
House and Street ____________.
Through Ventilation ____________.
Bedrooms ____________.
Other Rooms ____________.
Cleanliness ____________.
Repair ____________.

Ventilation and Lighting ____________.
Sink ____________.
Floor Gulley ____________.
Bath ____________.
Closet ____________.
Refuse-disposal ____________.

Further details as to any Insanitary Condition observed } ____________.
Disinfection ____________.
Home-Isolation ____________.
Home-work ____________.
Source of Infection ____________.
Cases in Vicinity ____________.

No. of Case.	Name.	Sex.	Age.	Occupation.	Place of Work or School, and Last Attendance.	Previous Attacks of Zymotic Disease or Previous Health.	Date of					Attack.		Primary Vaccination of all the Inmates.				Re-Vaccination of all the Inmates.		Further Remarks as to Vaccination.	Doctor and Date when first seen.
															Marks.						
							Notification.	Onset.	Rash.	Removal to Hospital.	Termination.	Type.	Result.	Date.	No.	Character.	Area.	Date.	Result.		

Points wanting in Case Register ____________.
Date of Visit ____________.
Informant ____________.

SECTION B.—METHODS OF THIS INQUIRY.

My inquiries into the *vaccinated condition of the inhabitants* have been carried on both in the infected and uninfected houses.

Infected houses.

a.—The inquiries at the infected houses, which were scattered about the town, were conducted by myself, in person, with a few unimportant exceptions; and many of the cases of small-pox I saw while in hospital, by the courtesy of the Assistant Medical Officer of Health, as well as at their own homes.

The particulars inquired into comprised the items mentioned on the preceding page, printed in a double page manuscript book. ("House to House" note books.) The particulars so obtained have been summarised into schedules, tables, and lists.

Date.

The investigation so conducted has been attended with some labour; but it seemed to be the only way to obtain accuracy of fact in detail, such as could form a basis for logical deduction. It was commenced in December 1892, and necessarily extended over many months, but the facts elicited *always had reference to the time when the eruption of small-pox appeared in the household.*

Total infected houses.

Altogether there were 457 buildings infected between May 10, 1892, and May 10, 1893. Access and information were not denied to us at any of these; but those buildings where precise particulars as to the vaccinated condition of the *other* inmates were not obtainable, have been excluded in making the vaccination tables. They were 20 in number:—

1 Borough Fever Hospital, } by reason of their
1 The Workhouse, } size and shifting
4 Common lodging houses, } population.
14 houses where the inmates had left and could not be traced to their new abodes,*

leaving a balance of 437 houses as the basis of most of our calculations.

A table showing the number of houses in which more than one case arose will be found at the end (p. 98). The 20 houses excluded from attack-rate calculations, contained 49 cases.

b.—In order the better to arrive at a true idea of the vaccinated condition of the people, a house-to-house visitation of houses *not invaded* by small-pox on similar lines to the above was made in the early part of 1893, under my supervision, by Drs. W. W. Lake and W. H. Fielden. The inquiries of these gentlemen were retrospective, and *had reference to the vaccinated state on August 1st*, 1892.

And in order to bring this inquiry within more reasonable limits, it was confined to a highly infected district around the old Borough Fever Hospital in Aikin Street.

In every possible instance we satisfied ourselves by inspection of the arms as to the vaccinated condition of the inmates. This was done in considerably more than half. It was found, on many occasions, that a determination to see for ourselves was an incentive to our informant to be precise as to the truth of any other evidence submitted to us.

This inquiry had reference to a representative district of the town as regards houses and people, and we had reason to believe from inquiries at other houses (uninfected and infected) in different parts of the town, that the results accurately represented the average condition of all the inhabitants.

SECTION C.—EXPLANATORY AND DEFINITIONS.

Vaccination classes.

Preliminary to what follows, it is necessary to explain that six "Vaccination Groups" have been adopted. The first three classes refer to persons vaccinated once only during their lifetime, generally in infancy. The fourth class refers to persons who have never been vaccinated; the fifth to those who have been vaccinated successfully twice or oftener during their lives; and the sixth to those who had previously had small-pox.

All the six groups mutually exclude each other, except in those few tables where it is expressly stated otherwise Thus, if a person came in Class VI., by reason of having previously had small-pox, he would be excluded from all the other columns; and if an individual has been successfully re-vaccinated he is placed only in Class V.

Class I.—"*Well-vaccinated*" includes all persons whose primary vaccination scars are fairly well marked in their foveation (or pitting), and of an aggregate area (irrespective of number) of half a square inch and upwards.

Class II.—"*Indifferently vaccinated*" includes (a) persons whose primary scars, though foveate, are in the aggregate (irrespective of number) under half a square inch area; and (b) other persons whose primary marks, irrespective of number or size, are entirely non-foveate and therefore generally indistinct (plane or flat or faint).

As regards the texture of the scars, "well " foveate (w. fov.)," "foveo-cicatricial (fov. " cic.)," plano-foveate (pl. fov.)," and "faintly " or slightly foveate (f. fov.)" scars are all included in Class I. if their collective area reaches the required half-inch standard.

All "plane," "flat," "faint," "indistinct," and "non-foveate" scars are included in Class II. of indifferent vaccinations.

Class III.—"*Doubtfully vaccinated*" are (a) those persons reputed to have been vaccinated on reliable authority, but who on inspection bore no marks; and (b) others where the only information obtainable was hearsay evidence of a somewhat equivocal character.

Class IV.—"*Unvaccinated*" persons, *i.e.*, persons not vaccinated 14 or more days before the appearance of the eruption within the house. Cases of concurrent vaccinia and variola are dealt with on p. 45.

Class V.—Persons who, besides having been successfully vaccinated in infancy, were *successfully* "*Re-vaccinated*" once or more before exposure to the infection of small-pox. In the *uninfected* houses August 1st, 1892, is taken as the date. In the *infected* houses the operation must have been performed more than 14 days before the patient therein developed the eruption, and matured successfully. Individuals in this class are excluded from the other classes, except where it is expressly stated otherwise.

Class VI.—Those who have, on good evidence, had a *previous attack of small-pox.* This class is also excluded from the other classes.

The term "Vaccinated Persons" includes Classes I. II., and III. added together, so that the "Doubtfully" vaccinated are classed as vaccinated persons, although had we possessed sufficient information they might have been shown to belong to the unvaccinated group (Class IV.).

The figures, therefore, which refer to unvaccinated persons may be taken as quite reliable. If, after exhausting every possible means of inquiry there existed any doubt as to the unvaccinated condition, the person has been included in the doubtfully "vaccinated" class (Class III.).

The vaccinated condition of a household always bears reference to the date of the eruption the first case in the house. The actual cases of small-pox themselves were classed by their vaccinated state 14 days before they developed the eruption.

The presence of characteristic scars on the upper arm was always regarded as indubitable evidence of successful vaccination. Of the hearsay evidence the most reliable was the mother's, then that of the other relatives and the doctor. It may be taken that a mother's affirmation "unvaccinated" was wholly reliable, but a mother's affirmation "vaccinated" was not always so.* It sometimes needed confirmation. The value of other evidence had to be judged by the kind of person, their opportunities for knowing, how they stood cross-examination, and other different qualities. The evidence of "the Doctor" was sometimes discounted by the fact that the eruption frequently hides the scars.

Confirmatory evidence was sought in all cases wherever the least doubt existed.

The size of each vaccination mark inspected was always measured by a gauge and recorded by the Roman numerals. I.=·502 sq. inches, II.=·282 sq. inches, III.=·196 sq. inches, IV.=·126 sq. inches. Generally these have been worked out in the following tables, but in case they should not have been, it is useful to remember that:—

1 mark of size I. = ·502 inch.
2 marks ,, II. = ·564 ,,
3 ,, ,, III. = ·588 ,,
and 4 ,, ,, IV. = ·504 ,,

are all just over the required standard of half a square inch total area.

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* The untraceable *cases* have been made available for calculation by the kindness of the Assistant Medical Officer of Health, in supplying particulars of these.

* *See* further remarks on this subject on p. 34, right-hand column.

Concerning those persons where reliable information, other than personal inspection, was obtainable as to their vaccination, the following expressions are used, "3 marks," "2, or 1, mark," or simply "marks." Persons reputed on good authority to bear three or more "marks" are placed in Class I. (well-vaccinated), those reported to have two marks or less are placed in Class II. (indifferently vaccinated). Most of those to whom the word "marks" is appended have, from the equivocal nature of the evidence, been included among the doubtful vaccinations (Class III.).

The best evidence of a previous attack of small-pox is extensive pitting on the face and elsewhere, but a less degree of pitting may occasionally result from varicella or acne. A circumstantial statement by a reliable person on the subject is of some value if small-pox was known to be prevalent at the time and in the place, and especially if other cases occurred in the same house at that time.

The instances which came under my notice were not sufficiently recent for me to derive any satisfaction by references to "doctors" or hospitals, though several attempts were made.

Types of small-pox.

As regards the type of small-pox, the cases are grouped into—

Class I.—Mild cases, modified, or so-called varioloid, where the eruption has been scanty, often abortive, and the constitutional symptoms slight or absent. Slight and very mild cases are here included.

Class II.—Discrete cases, where the eruption has been moderate in quantity, but the pocks have always matured, and the constitutional symptoms more or less marked. Semi-discrete and severe-discrete are classed as discrete.

Class III.—Confluent cases, where the eruption has been plentiful, and the pocks, at least on the face, running together; and the constitutional symptoms severe. Semi-confluent, Coherent, Conglomerate, Corymbose, Hæmorrhagic, and Malignant cases are included in this group.

The words "*fatality*" and "*case mortality*" are synonymous.

Age has reference to the completed age last birthday.

SECTION I.—CONDITION OF THE PEOPLE OF WARRINGTON IN 1892 AS REGARDS PRIMARY VACCINATION.

The arrangements for Vaccination are mentioned on pp. 17 and 20.

The Vaccination Officer informed me that there were no prosecutions for non-vaccination in the years 1891–3; and the people of Warrington are not as a whole, so far as I could ascertain, opposed to the practice of vaccination. In general terms it is a well vaccinated town.

Cases of omission to be vaccinated in infancy were very generally due to the removal of a child from the place of its birth during the first six months of its life. Under these circumstances the Vaccination Officer of Warrington does not receive any intimation, and it is only by chance that the child comes under the notice of the authorities at its new residence.

There does not seem to be at the present time any efficient process for following up such cases. Nothing is easier than thus to evade the vaccination laws; and there is no periodic examination of schools such as would discover these cases.

As regards the causes of non-vaccination in Warrington I found in very few instances that vaccination was postponed or not performed because of ailing health at the time when vaccination was due; in very rare instances there was objection on part of parents; and some children were reported insusceptible to vaccination (5 in 1890, 6 in 1891, and 6 in 1892). In the great majority of unvaccinated persons, passive negligence on the part of the parents was the cause of non-vaccination.

The result of our inquiries among the 3,394 persons living in a very representative district of the town shows that only ·8 per cent. of these had not undergone primary vaccination, excluding from this calculation persons known on good evidence to have previously had an attack of small-pox; and, on the other hand, that only 2·7 per cent. had been re-vaccinated, both calculations having reference to the virtual date of commencement of the epidemic, August 1st, 1892.

This Section will deal with :—

(*a.*) Vaccinated condition in the infected houses.
(*b.*) Vaccinated condition in a typical district of the town including both infected and uninfected houses.
(*c.*) Result of the Vaccination Officer's house-to-house inquiry.
(*d.*) Summary and comparison of (*a*) and (*b*).
(*e.*) Proportion of births to vaccinations (L. G. Bd. returns in Table VIII.).

Subsection a.—Vaccinated State in Infected Houses.

The table below (Table V.) shows the number and the condition, as regards vaccination of the inmates, at all and at certain ages, of the 437 infected houses before mentioned. The figures have reference in each infected house to the date when the inmate affected (or the first inmate if more than one was affected) developed the eruption.

An examination of this table shows amongst other points :—

1. That 4·2 per cent. of these 2,535 persons were unvaccinated at the time their houses were invaded by small-pox; 95·8 per cent. having been vaccinated, revaccinated, or protected by previous small-pox.

TABLE V.

VACCINATED CONDITION of 2,535 Persons living in 437 INFECTED HOUSES in which the Vaccinated State of both the Cases, and ALL THE OTHER INMATES, was ascertained by Personal Inquiry.

No. of Persons and Age-periods.	I. Well-vaccinated.		II. Indifferently Vaccinated.		III. Doubtful Vaccinations.		IV. Unvaccinated.		V. Revaccinated.		VI. Previously had Small-pox.	
Of 49 persons aged 60 and upwards there were - -	14	*28 per cent.*	21	*43 per cent.*	4	*8 per cent.*	1	*2 per cent.*	3	*6 per cent.*	6	*12 per cent.*
Of 127 persons aged 50–60 years there were - - -	38	*30* „	61	*48* „	9	*7* „	6	*4* „	4	*3* „	9	*7* „
Of 229 persons aged 40–50 years there were - - -	117	*51* „	76	*33* „	15	*7* „	5	*2* „	8	*3* „	8	*3* „
Of 286 persons aged 30–40 years there were - - -	131	*45* „	102	*36* „	20	*7* „	7	*2* „	12	*4* „	14	*5* „
Of 475 persons aged 20–30 years there were - - -	279	*58* „	140	*29* „	20	*4* „	14	*3* „	19	*4* „	3	*0·60* „
Of 681 persons aged 10–20 years there were - - -	460	*67* „	168	*25* „	16	*2* „	19	*3* „	17	*2* „	1	*0·14* „
Of 688 persons aged 0–10 years there were - - -	484	*70* „	133	*19* „	16	*2* „	55	*8* „	0	*0* „	0	*0·* „
Making a total of 2,535 persons of all ages - - - -	1,523	*60 per cent.*	701	*28 per cent.*	100	*4 per cent.*	107	*4 per cent.*	63	*2 per cent.*	41	*1·6 per cent.*

NOTE.—This table gives the actual numbers of persons, including both patients and their relatives, in ordinary type, and per-centages in italics.

2. That upwards of half (60 per cent.) of these 2,535 persons came into the well-vaccinated class;

that 28·0 per cent. showed indifferent vaccination,
that 4·0 „ „ doubtful „
that 4·2 „ were unvaccinated,
and that 2·4 „ had been revaccinated,

when their houses were invaded by small-pox.

3. That the largest proportion of the *well-vaccinated* persons were either under 10 years of age or between 10 and 20 years of age (70 and 67 per cent.), and that as age advanced the numbers of "well-vaccinated" became proportionally fewer.

4. That among the *indifferently and doubtfully* vaccinated, the age proportions work out in a converse direction though not with such marked differences.

Sub-section b.—Vaccinated Condition of the District around the old Hospital (Aikin Street).

Vaccinated condition in the Aikin Street district.

The Aikin Street district was a highly infected one. It is probable that most of the inhabitants were exposed to infection at some time during the epidemic.

This district of the town was a very representative one as regards size of house, number of inhabitants per house, and the occupations, habits, and mode of life of the people. The table below (Table VI.) prepared for me by Dr. W. E. Fielden gives the result of our house-to-house inquiry in that district, and shows the vaccinated condition of all the people living within 300 yards of the old Fever Hospital; those in the uninfected houses on August 1st, 1892, and those in the infected houses on the date when the patient developed the eruption.

An examination of this table shows, amongst other points, that all but 0·8 per cent. of these 3,394 persons were vaccinated, as compared with 4·2 per cent. unvaccinated in the infected houses in all parts of the town.

There were 3,116 persons in the uninfected houses, and 278 in the infected houses in this district. Of the former 0·74 per cent. were unvaccinated and of the latter 2·16 per cent. Persons who had previously had small-pox are excluded from both of these calculations.

Sub-section c.—Report of Vaccination Officer on vaccinated state of the town, December, 1892.

A house-to-house inquiry, without inspection of arms, was conducted in *November and December, 1892*, with great zeal by the Vaccination Officer and two assistants, in certain districts of the town.

His results differed somewhat from ours inasmuch as his inquiry had reference to a different period of time, and simple inquiry at the door failed, in some instances, to elicit the existence of an unvaccinated inmate, or to ascertain the quality of vaccination in others. Both infected and uninfected houses were visited. The Vaccination Officer has kindly supplied me with the following particulars.

The inquiry was carried on in the two chiefly infected districts of the town, viz.:—

(*a.*) Around the old fever hospital, comprising the greater part of Whitecross and St. Austin's wards, and a portion of the extra-parliamentary district of Sankey Bridges. This is an area which includes, but is larger than, the field of our last mentioned inquiries.
1,701 houses were visited, containing 7,664 persons; of whom—
7,641 (99·7 per cent.) were reported to be vaccinated.
23 (0·3 per cent.) were reported to be unvaccinated.
981 (12·8 per cent.) were reported to have been re-vaccinated at that date.[*]

(*b.*) Around the new small-pox hospital (Dallam Lane), comprising Bewsey ward and almost the whole of Orford ward.
1,657 houses were visited, containing 8,356 persons; of whom—
8,306 (99·4 per cent.) were reported as vaccinated.
50 (0·6 per cent.) were reported as unvaccinated.
789 (9·4 per cent.) were reported as revaccinated.[*]

Taking these two districts together—
3,358 houses were visited, containing 16,020 persons.[†]
15,946 (99·55 per cent.) were reported as vaccinated.
73 (00·45 „) „ unvaccinated.
1,770 (11·04 „) „ re-vaccinated.[*]

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[*] To end of December 1892.
[†] More than quarter of the population of Warrington.

TABLE VI.

SHOWING the VACCINATED CONDITION of 3,394 persons living in the 620 Uninfected and 43 Infected Houses within 300 yards of the Old Borough Hospital (**Aikin Street Area**). THE 93 RE-VACCINATED PERSONS HAVE BEEN INCLUDED IN THE FIRST TWO COLUMNS (I., II., AND III.), AS WELL AS IN COLUMN V.

Age periods.	I. Well Vaccinated.			II. and III. Indifferently and doubtfully Vaccinated.			IV. Unvaccinated.			V. Re-vaccinated.			VI. Previous Small-pox.		
	No. in Un-infected Houses.	No. in In-fected Houses.	All Houses.	No. in Un-infected Houses.	No. in In-fected Houses.	All Houses.	No. in Un-infected Houses.	No. in In-fected Houses.	All Houses.	No. in Un-infected Houses.	No. in In-fected Houses.	All Houses.	Persons in Un-infected Houses.	Persons in In-fected Houses.	All Houses.
Of 78 persons aged 60 and upwards there were - -	14	1	15	52	1	53	1	0	1	5	0	5	9	0	9
Of 145 persons aged 50–60 there were - -	53	3	56	67	7	74	2	0	2	8	1	9	12	1	13
Of 263 persons aged 40–50 there were - -	113	15	128	112	13	125	1	0	1	20	1	21	7	2	9
Of 456 persons aged 30–40 there were - -	225	13	238	187	14	201	3	1	4	26	3	29	12	1	13
Of 566 persons aged 20–30 there were - -	314	18	332	209	10	219	2	0	2	9	1	10	13	0	13
Of 796 persons aged 10–20 there were . -	504	66	570	193	24	217	2	0	2	13	4	17	7	0	7
Of 488 persons aged 5–10 there were - -	331	28	359	113	11	124	3	2	5	2	0	2	0	0	0
Of 504 persons aged 1–5 there were - -	356	24	380	108	10	118	4	2	6	0	0	0	0	0	0
Of 98 persons aged under 1 there were - -	63	5	68	19	5	24	5	1	6	0	0	0	0	0	0
Of 3,394 persons at all ages there were -	1,973	173	2,146	1,060	95	1,155	23	6	29	83	10	93	60	4	64

NOTE.—The 620 uninvaded houses contained 3,116 inmates. The 43 invaded houses contained 278 inmates. The term "invaded" or "infected" means here infected with small-pox prior to October 4th, 1892, 15 days after the patients were shifted to the New Hospital. 5·0 persons per house in uninfected houses, 6·4 persons per house in infected houses.

Sub-section d.—Summary.

The table below (Table VII.) shows at once the result of my two inquiries, for comparison.

If, as I believe, the Aikin Street area may be regarded as a sample of the vaccinated condition of the whole town—

- 63·2 per cent. of the inhabitants of the town were well vaccinated (primarily);
- 34·0 per cent. indifferently and doubtfully vaccinated (primarily), including, as pointed out on p. 22, some who might have turned out to be unvaccinated;
- 0·8 per cent. were unvaccinated; and
- 1·9 per cent. had previously had small-pox;

at the date to which my inquiries on these points had reference (August 1st, 1892).

And, finally, that 2·7 of the inhabitants had been re-vaccinated prior to that date. This figure has to be modified for the town generally (p. 43).

Sub-section e.—Proportion of Public Vaccinations to Births per Annum.

The table below (Table VIII.) shows the number of births compared with the number of vaccinations done each year from 1872 to 1892 inclusive, from the Local Government Board returns.

The per-centage of the births in the Warrington Union which remain unaccounted for each year is small.

TABLE VII.

GIVING a SUMMARY of the two Inquiries into the Vaccinated State of the Borough of Warrington (1892).

———	Well vaccinated.		Indifferently vaccinated.		Doubtful vaccinations.		Unvaccinated.		Re-vaccinated.		Previously had Small-pox.	
	Number of Persons.	Per cent.	Number of Persons.	Per cent.	Number of Persons.	Per cent.	Number of Persons.	Per cent.	Number of Persons.	Per cent.	Number of Persons.	Per cent.
A.*—2,535 persons in 437 infected houses, scattered all over the town (personal inquiry), Table V. - - - -	1,523	*60·0*	701	*27·6*	100	*3·9*	107	*4·2*	63*	*2·5*	41	*1·6*
B.†—3,394 persons in { 43 infected houses - 620 uninfected houses } situated within 300 yards radius of the old fever hospital (Aikin Street) (personal inquiry), Table VI. - - -	2,146	*63·2*	1,155	*34·0*	Included in preceding column.		29	*0·8*	93‡	*2·7*	64	*1·9*

* On the date when the first patient in the house developed the small-pox eruption.
† On August 1st, 1892.
‡ These persons are also included in the first two columns.

TABLE VIII.

Particulars of BIRTHS REGISTERED and VACCINATIONS PERFORMED in the WARRINGTON UNION during the 21 years 1872–1892. The Union includes but is larger than the Borough (p. 82).*

Year.	Births registered during Year.	Of the Children whose Births were registered during the Year given in the First Column, by the 31st January in the Year next but one following that Year there were:—						
		Successfully Vaccinated.	Certified as insusceptible of Vaccination.	Had Small-pox.	Died Unvaccinated.	Vaccination postponed by Medical Certificate.	Remaining.	The Children not finally accounted for (including Cases postponed) being per cent. of Births.
1872 - - -	2,217	1,882	12	2	204	116		5·2
1873 - - -	2,343	1,762	1	0	181	8	391	17·0
1874 - - -	2,481	2,185	2	1	251	12	30	1·7
1875 - - -	2,508	2,209	0	0	236	17	46	2·5
1876 - - -	2,704	2,400	0	0	232	21	51	2·7
1877 - - -	2,670	2,320	2	0	208	32	108	5·2
1878 - - -	2,710	2,268	1	0	263	35	143	6·6
1879 - - -	2,770	2,337	2	0	275	33	123	5·6
1880 - - -	2,826	2,311	0	0	317	56	142	7·0
1881 - - -	2,841	2,334	1	0	314	30	162	6·8
1882 - - -	2,819	2,268	0	0	332	16	203	7·8
1883 - - -	2,976	2,369	7	0	359	114	127	8·1
1884 - - -	3,021	2,527	4	0	398	20	72	3·0
1885 - - -	2,869	2,470	1	0	276	34	88	4·3
1886 - - -	2,904	2,456	6	0	338	19	85	3·6
1887 - - -	2,936	2,482		0	331	24	96	4·1
1888 - - -	2,973	2,484	1	0	298	26	164	6·4
1889 - - -	3,055	2,573	4	0	296	28	154	6·0
1890 - - -	3,074	2,597	5	0	315	13	144	5·1
1891 - - -	3,334	2,835	13	0	354	20	112	4·0
1892 - - -	3,331	2,889	5	0	321	20	96	3·5

NOTE.—* These particulars are from the Local Government Board returns.

SECTION II.—HAD PRIMARY VACCINATION ANY POWER TO PROTECT FROM INFECTION.

A distinction is here drawn between the power, if it exist, of efficient vaccination to protect from the infection of small-pox (Section II.), and its power, if any, to modify the disease when once contracted (Section III.).

The question of PROTECTION may be approached by investigating—

(*a*.) The relative proportion of unvaccinated persons in the infected and uninfected houses respectively.
(*b*.) The relative vaccinated condition of the vaccinated persons in the infected and uninfected houses respectively.
(*c*.) The different proportions of persons attacked among the several vaccinated states dwelling in the infected houses.
(*d*.) Similar facts as regards a typical district of the town.
(*e*.) A comparison of an outbreak of small-pox in a vaccinated and unvaccinated community.

Sub-section a.—Proportion of Unvaccinated Persons in Infected and Uninfected Houses respectively.

In the preceding section we saw (Table V., *ante*) that 4·2 per cent. of the 2,535 dwellers in the 437 houses invaded by small-pox were unvaccinated persons. But as a result of our house-to-house inquiry (Table VI., *ante*) in the Aikin Street district, which comprised 43 infected houses and 620 uninfected houses, we found that only 0·8 per cent. of the 3,394 inhabitants were unvaccinated. This is a large difference (five times), but it becomes still more remarkable when one finds, on examining the 620 uninfected houses alone, that only 0·74 per cent. of the 3,116 inmates were unvaccinated.

Sub-section b.—Comparison of Vaccinated Condition in Infected and Uninfected Houses.

The table given below (Table IX.) shows the relative vaccinated condition in infected or uninfected houses respectively, extracted from the figures given in Tables V. and VI.

These figures are strictly comparable in all respects, the houses and the inmates were living practically under the same conditions.* The only material differences being—

(i) that Class B. contains a larger proportion of well-vaccinated persons, and of indifferently and doubtfully vaccinated persons, and a smaller proportion of unvaccinated than class A., and
(ii) that the houses included in Class A. were invaded by small-pox; while those in Class B. were not.

Sub-section c.—The relative Proportions of Persons attacked among the several Vaccinated Groups of People in the Infected Houses.

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The possibility or impossibility of vaccination to protect from the infection of small-pox may best be studied by a critical examination of the vaccinated state of all persons similarly exposed to the infection of small-pox, and comparing the "attack-rate" in the different groups. Now, bearing in mind the social class affected with small-pox, and their habits of life, it may be taken as nearly certain that all the inmates of an infected house were exposed in some degree to infection, either before or after recognition of the disease; either from the patient, or from the same source as the patient.

Table X., next page, shows that in the 437 infected houses there were 2,387 persons who were classed as having been vaccinated at some time of their lives before the house became infected, and of these 553 or *23 per cent.* were attacked with small-pox. Included in this calculation are 100 persons about whose vaccination I was unable to satisfy myself. On the information before me some of them might or might not have been vaccinated (p. 22): 25 of the cases arose amongst them.

In the same houses were found 107 unvaccinated persons, and of these 60 or *56 per cent.* were attacked with small-pox.

I could ascertain no reason for this remarkable difference in the attack-rate in the two classes, unless the fact of vaccination protected the vaccinated persons from being attacked by small-pox. Being members of the same families, they lived in the same houses (which, be it noted, were of a remarkably uniform type), ate the same food, often did the same work, and were exposed to the same hereditary and external influences. But the one class was vaccinated and had a small-pox attack-rate of 21 and the other was unvaccinated and had an attack-rate of 56.

But let us inquire more particularly into the quality of the vaccination in the infected houses, as defined on p. 22, and see whether different qualities of vaccination afforded different degrees of protection from infection. The table on next page (Table X.), giving the actual number of persons, is the outcome of my investigations in this subject.

It may be taken that all these persons were exposed, and in general terms pretty equally exposed, to the infection of small-pox. It will be seen from this table:—

TABLE IX.

A COMPARISON of the VACCINATED CONDITION of PERSONS in INFECTED and UNINFECTED HOUSES respectively. (Result of Personal Inquiry.)

—	Well Vaccinated Persons.		Indifferently and Doubtfully Vaccinated Persons.		Unvaccinated Persons.		Persons who had previously had Small-pox.	
A.—There were 2,472 persons (excluding 63 re-vac.) in the 437 *infected* houses, situated in different parts of the town (see Table V., *ante*), of whom	1,523	61·6 per cent.	801	32·4 per cent.	107	4·3 per cent.	41	1·6 per cent.
B.—There were 3,116 persons in the 620 *uninfected* houses, situated in the Old Fever Hospital District (see Table VI., *ante*), of whom - -	1,973	63·3 per cent.	1,060	34·0 per cent.	23	0·7 per cent.	60	1·9 per cent.

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* With the exception of number of inmates per house *vide* Part IV. of this Report, p. 81.

1. That the proportion of those attacked among the indifferently and doubtfully vaccinated is higher than that among the well-vaccinated.
2. That the number attacked among the unvaccinated is more than twice as great as the doubtfully vaccinated group; and
3. That a larger proportion were attacked amongst those who had had small-pox previously than amongst the re-vaccinated (12 and 11 per cent. respectively).

Sub-section d.—The Attack Rates among the Vaccinated and Unvaccinated in a representative District in the Town.

Table XI., given below, shows the relative incidence of small-pox on the vaccinated and the unvaccinated at different age periods in the highly infected area near the old Borough Fever Hospital.

It will be seen that the attack rate was heavier, and the class of case more severe, among the unvaccinated than it was among the vaccinated.

Sub-section e.—Comparison of a Vaccinated with an Unvaccinated Community.

A comparison of this epidemic with one in the same community before vaccination was practised will be found in Section IV. (p. 36 *et seq.*), which deals with the historical prevalence of small-pox in Warrington in former years. In *Sub-section c* (p. 39) of that Section it will be seen—

1. That the "attack rates" in the unvaccinated (1773) and vaccinated (1892) communities differ as 64 per 1,000 and 12 per 1,000 respectively.
2. That whereas the disease was endemic in the unvaccinated community it is only epidemic in the (almost entirely) vaccinated community; and
3. That the average number of deaths from small-pox in practically unvaccinated Warrington, 1773 to 1842, was 35 per annum (*i.e.*, taking those years of which a record exists, p. 41); and in vaccinated (*i.e.*, in general terms) Warrington, 1843–1891, was 5·6 per annum. The population had meantime grown from 8,000 to 52,000 (p. 40).

As regards Warrington in the present day, out of 2,535 persons dwelling in 437 *infected houses*, of whom 2,324 had been vaccinated once in their lives, and 107 had never been vaccinated, the attack rate amongst the former was 235 per 1,000 and among the latter 561 per 1,000. (Table X., below.)

Finally, in the highly *infected district*, the Aikin Street area (Table XI., below), out of 3,301 vaccinated persons dwelling in that area 26 per 1,000 were attacked, and out of 29 unvaccinated persons 207 per 1,000 were attacked.

TABLE X.

AN ANALYSIS of the Population in 437 INFECTED HOUSES as regards the quality of their Vaccination and the Number of Persons attacked in the respective Groups.*

——	Well Vaccinated.	Indifferently. Vaccinated.	Doubtful Vaccinations.	Unvaccinated.	Re-vaccinated.	Had Small-pox previously.
2,535 persons in 437 infected houses -	1,523	701	100	107	63	41
Of whom 618 persons were attacked by small-pox.	329	192	25	60	7	5
Per-centage of persons attacked -	*21·6 per cent.*	*27·4 per cent.*	*25·0 per cent.*	*56·1 per cent.*	*11·1 per cent.*	*12·2 per cent.*
58 deaths - - -	10	17	10	21	0	0
Case Mortality (per cent.) (Table, p. 49)	*3·0 per cent.*	*8·8 per cent.*	*40·0 per cent.*	*35·0 per cent.*	*0·0 per cent.*	*0·0 per cent.*

* The Workhouse, Fever Hospital, Common Lodging Houses, and a few houses whose inmates could not be traced, are excluded from this calculation as it was not possible to obtain the facts as to vaccination of the other inmates in these, with the same degree of accuracy as in the remaining 437 houses, p. 22.

It will be observed that the case-mortality among the doubtfully vaccinated and the unvaccinated is very heavy, though both approximate to Marson's unvaccinated fatality (37 per cent.) based on 2,654 cases (Reynold's system, Vol. I., p. 238). The heavy mortality among the doubtfully vaccinated appears to be due partly to the drinking habits of the inhabitants, and partly to the circumstance that many were probably unvaccinated persons.

TABLE XI.

RELATIVE NUMBER of SMALL-POX CASES amongst (*a.*) the vaccinated (including doubtful vaccinations and re-vaccinations, but excluding previous Small-Pox), and (*b.*) the unvaccinated persons, respectively, in a highly infected area, viz., the 300 yards AIKIN STREET AREA.

——	Persons protected by Vaccination in 300 yards Aikin Street area.								Unvaccinated people in 300 yards Aikin Street area.							
	60 and older.	50–60	40–50	30–40	20–30	10–20	0–10	All Ages.	60 and older.	50–60	40–50	30–40	20–30	10–20	0–10	All Ages.
No. of people in area - - - -	68	130	253	439	551	787	1,073	3,301	1	2	1	4	1	3	17	29
Mild cases - - - - - -	2	2	2	7	15	16	7	51	0	0	0	0	0	0	0	0
Discrete cases - - - - - -	0	1	0	5	6	10	1	23	0	0	0	0	0	1	1	2
Confluent cases - - - -	0	0	2	2	5	1	0	10	0	0	0	0	0	2	2	4
Total cases - - - - - -	2	3	4	14	26	27	8	84	0	0	0	0	0	3	3	6
Deaths - - - - - - -	0	0	2	0	0	0	0	2	0	0	0	0	0	1	2	3

NOTE.—The vaccinated state of the people refers to August 1st, 1892. The cases are those which arose in that district between August 1st and October 4th, 1892.

SECTION III.—HAD PRIMARY VACCINATION ANY POWER TO MODIFY THE SEVERITY AND FATALITY OF SMALL-POX?

Sub-section a.—The Types of Case and Fatality occurring among the Vaccinated and Unvaccinated respectively.

Severity.

It will be seen from Table XII. at foot that,—

Out of 586 *primarily vaccinated* cases 321 were mild, 137 discrete, and 128 confluent;

Out of 68 *unvaccinated* cases 3 were mild, 17 discrete, and 48 confluent.

Thus 22 per cent. of the vaccinated cases (including 12 doubtfully vaccinated persons) were confluent, and 70 per cent. of the unvaccinated were confluent.

Case mortality.

Amongst the 667 cases which occurred between May 10, 1892, and May 10, 1893, 62 were fatal, giving a case-mortality of 9·3 per cent.

Out of 586 vaccinated and doubtfully vaccinated cases 38 were fatal; case-mortality, 6·5 per cent. (8 re-vaccinated and five previous small-pox cases are omitted).

Out of 68 unvaccinated cases 24 were fatal; case-mortality, 35 per cent.

Thus the case-mortality among the unvaccinated is five and a half times as great as that amongst the vaccinated.

Sub-section b.—The Type of Case and Fatality occurring among the different Classes of Vaccinated Persons.

It will be seen from Tables XII. and XIII. that as the vaccinated condition was less perfect (as measured by current standards), so in proportion the cases were more severe.

Out of the 350 well-vaccinated cases—
60 per cent. were mild,
23 „ „ discrete, and
17 „ „ confluent.
2·9 „ *died.*

Out of the 208 indifferently vaccinated cases—
56 per cent. were mild,
22 „ „ discrete, and
22 „ „ confluent.
8·2 „ *died.*

Out of the 28 doubtfully vaccinated cases—
43 per cent. were mild,
14 „ „ discrete, and
43 „ „ confluent.
39·0 „ *died.*

As regards the fatality of the disease—

I.—Case mortality in well-vaccinated cases, 2·9 per cent.

II.—Case mortality in indifferently vaccinated cases, 8·2 per cent.

III.—Case mortality in doubtfully vaccinated cases, 39·3 per cent.

IV.—Case mortality in unvaccinated cases, 35·3 per cent.

It follows therefore from the foregoing:—

(1.) That small-pox as it occurred amongst the WELL-VACCINATED was 3 times less fatal than amongst those who were indifferently vaccinated, 13 times less fatal than amongst the doubtfully vaccinated; and 12 times less fatal than amongst the unvaccinated.

(2.) That the disease as it occurred among the INDIFFERENTLY VACCINATED was 4½ times less fatal than amongst the doubtfully vaccinated; and 4 times less fatal than amongst the unvaccinated.

(3.) That the disease as it occurred amongst persons classed as *doubtful vaccinations* (definition, page 22), was rather more fatal than amongst the unvaccinated.

(4.) And finally, that the disease as it occurred amongst the *vaccinated cases*, including those classed as *doubtful* vaccinations, was 5½ times less fatal than it was amongst the *unvaccinated.*

The fatality at different age periods is given in Table XVII., p. 35.

TABLE XII.

AN ANALYSIS of the different types of 667 SMALL-POX CASES occurring in the different VACCINATION GROUPS.

—	Mild Cases.	Discrete Cases.	Confluent Cases.	Totals.	Deaths.	Case Mortality.
350 well-vaccinated cases (Class I.) - - -	205	83	62	350	10	*2·9*
208 indifferently vaccinated (Class II.) - -	104	50	54	208	17	*8·2*
28 doubtful vaccinations (Class III.) - - -	12	4	12	28	11	*39·3*
68 unvaccinated cases (Class IV.) - - -	3	17	48	68	24	*35·3*
8 successfully re-vaccinated cases (Class V.) - -	2	4	2	8	0	*0*
5 cases had had small-pox previously (Class VI.) -	3	2	0	5	0	*0*
Totals - - - -	329	160	178	667	62	*9·3*
Number of deaths in each type of case - -	0	3	59	62	—	—
Per-centage fatality in each type of case - -	*0*	*1·87*	*33·14*	*9·3*	—	—

Case-mortality amongst vaccinated and doubtfully vaccinated persons = 6·4 per cent.
„ „ unvaccinated = 35·2 per cent.

TABLE XIII.

AN ANALYSIS of the Proportion of the different VACCINATION GROUPS occurring in each type of the 667 CASES of SMALL-POX.

—	A. Mild Cases of Small-Pox, 29.						B. Discrete Cases of Small-Pox, 160.						C. Confluent Cases of Small-Pox, 178.						D. Fatal Cases of Small-Pox, 62.					
	Vaccinated State.						Vaccinated State.						Vaccinated State.						Vaccinated State.					
	I.*	II.	III.	IV.	V.	VI.	I.	II.	III.	IV.	V.	VI.	I.	II.	III.	IV.	V.	VI.	I.	II.	III.	IV.	V.	VI.
Cases - -	205	104	12	3	2	3	83	50	4	17	4	2	62	54	12	48	2	0	10	17	11	24	0	0
Per-centages -	62·3	31·7	3·6	0·9	0·6	0·9	51·9	31·2	2·5	10·6	2·5	1·2	34·8	30·3	6·7	26·9	1·1	0·0	16·1	27·4	17·7	38·7	0	0

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* The Roman numerals indicate the various vaccinated classes as defined on p. 22, *ante.* I. "Well-vaccinated." II. "Indifferently vaccinated." III. "Doubtfully vaccinated." IV. "Unvaccinated." V. "Re-vaccinated." VI. "Previously affected with small-pox."

TABLE XIV.

GIVING PARTICULARS concerning all the VACCINATED Persons, 38 in number, who were certified to have DIED OF SMALL-POX May 10, 1892—May 10, 1893.

Book Reference.	No. of Case.	Residence.	Name.	Sex.	Age at Death.	Occupation.	Date of					Attack.		Primary Vaccination.			Revaccination.		Evidence as to Vaccination.	Previous Health.	Complications and Remarks.
							Notification.	Onset.	Rash.	Removal to Hospital.	Termination.	Type.	Result.	Date.	Marks.		Date.	Result.			
															No.	Character.					
XI./1	12	17, Winwick Road -	A—, John -	M.	31	Brewer's labourer.	Aug. 24	Aug. 18	Aug. 22	Aug. 24	Aug. 30	Confluent	Died at Aiken Street Hospital.	Infancy	2	—	Never	—	Mother's evidence	Good - -	—
II./3	79	Ice Cottage, Heath Side.	L——, Peter -	M.	20	Fish salesman	Sept. 22	Sept. 18	Sept. 23	Sept. 22	Oct. 1	Confluent	Died at Hope Hospital.	Doubtful.	—	—	—	—	See Remarks on p. 34.	„ - -	Delirium.
II./3	75	„ „	L——, James -	M.	8	School -	Sept. 22	Sept. 18	Sept. 20	Sept. 22	Sept. 29	Confluent	Died at Hope Hospital.	Infancy	—	—	—	—	See Remarks on p. 34.	„ - -	—
I./9	51	14, New Road -	D—, Samuel -	M.	58	File cutter -	Sept. 12	Sept. 7	Sept. 10	Sept. 20	Sept. 25	Confluent	Died at Hope Hospital.	Infancy	3	Good marks.	Never	—	Mother and daughter's evidence.	Said never to have been a strong man: much emaciated.	—
IV./6	96	48, Aikin Street -	Y—, Martha -	F.	27	Fustian cutter.	Sept. 27	Sept. 23	Sept. 25	Sept. 26	Oct. 7	Confluent	Died at Hope Hospital.	Infancy	3	—	Never	—	Mother's evidence	Said to be weak with grief for loss of husband, and nursing an infant five months old at time of death.	—
XIV./8	98	14, Cockhedge Lane	C—, Margaret	F.	39	Housewife -	Sept. 28		Sept. 25	Sept. 28	Oct. 6	Confluent	Died at Hope Hospital.	Infancy	2	Small marks.	Never	—	Nurse and daughter's evidence.	Very alcoholic, and had had delirium tremens; lived in an overcrowded house.	—
XIV./8	112	„ „	C—, Edward -	M.	40	Ironworker -	Sept. 30		Sept. 30	Sept. 30	Oct. 10	Confluent	Died at Hope Hospital.	Infancy	2	Small marks.	Never	—	Nurse and daughter's evidence.	Ditto ditto	—
VIII./7	117	17, Turner Street -	E—, Thomas -	M.	18	Hawker -	Oct. 1	Sept. 27	Sept. 28	Oct. 1	Oct. 27	Discrete	Died at Hope Hospital.	Infancy	3	Good marks.	Never	—	Doctor's evidence	No information -	Died one month after onset of small-pox, and death certificate gives, as secondary cause, pyæmia.
VI./20	144	78, Howard Street -	W—, George -	M.	46	Wireworker -	Oct. 7	Oct. 2	Oct. 6	Oct. 7	Oct. 13	Confluent	Died at Hope Hospital.	Infancy	4	Good marks.	Never	—	Wife's evidence -	Stated to be a sober man.	Hospital stated to be very crowded at the time.
X./26	177	2, Philip Street -	M—, Martha -	F.	36	Grocer's shop	Oct. 16	Oct. 14	Oct. 15	Oct. 16	Oct. 21	Confluent	Died at Hope Hospital.	Infancy	3	Good marks.	Never	—	Eldest daughter -	Reputed sober.	—
XI./10	184	341, Winwick Road	H—, Jane -	F.	32	House-work -	Oct. 17	Oct. 13	Oct. 15	Oct. 17	Oct. 23	Confluent	Died at Hope Hospital.	Infancy	2	Good marks.	Never	—	Doctor and husband's evidence.	Reputed sober.	Suffering from "septicæmia after miscarriage," death certificate.

Table XIV.—*continued.*—Giving Particulars concerning all the VACCINATED Persons, 38 in number, who were certified to have DIED OF SMALL-POX May 10, 1892—May 10, 1893.

Book Reference.	No. of Case.	Residence.	Name.	Sex.	Age at Death.	Occupation.	Date of					Attack.		Primary Vaccination.			Revaccination.		Evidence as to Vaccination.	Previous Health.	Complications and Remarks.
							Notification.	Onset.	Rash.	Removal to Hospital.	Termination.	Type.	Result.	Date.	Marks.		Date.	Result.			
															No.	Character.					
X./30	186	4, Blue Coat Street	H——, William	M.	36	Journeyman tool maker.	Oct. 17	Oct. 13	Oct. 16	Never	Oct. 17	Hæmorrhagic.	Died at home -	Infancy	2	Faint marks	Never	—	Wife's evidence -	Teetotaler.	—
X./26	190	2, Philip Street -	M——, Joseph -	M.	34	Journeyman wire drawer.	Oct. 18	Oct. 14	Oct. 16	Never	Oct. 18	Malignant.	Died at home -	Infancy	3	—	Never	—	Eldest daughter and mother-in-law who nursed him.	Reputed sober.	—
XII./30	191	23, Portland Street	B——, Thomas -	M.	31	Contractor's carter.	Oct. 18	—	Oct. 17	Oct. 18	Oct. 25	Confluent	Died at Hope Hospital.	Infancy	2	Good marks.	Never	—	Doctor and mother-in-law.	Drank heavily.	—
VIII./21	202	10, Orford Lane -	C——, Elizabeth	F.	30	Housewife -	Oct. 20	Oct. 17	Oct. 19	Oct. 20	Oct. 27	Confluent	Died at Hope Hospital.	Infancy	1	Faint mark.	Never	—	Doctor - -	Reported a very delicate woman.	—
XI./27	209	154, Winwick Road	B——, James -	M.	27	Gas stoker -	Oct. 22	Oct. 15	Oct. 20	Oct. 22	Oct. 25	Confluent	Died at Hope Hospital.	Infancy	2	"Large marks."	Never	—	Sister-in-law -	Teetotaler; reported to have had "feverish" attacks two or three times a year in which he used to ramble.	—
IV./19	232	115, Bostock Street -	A——, William -	M.	41	Book keeper at wire works.	Oct. 28	—	Oct. 26	Oct. 28	Nov. 9	Confluent	Died at Hope Hospital.	Infancy	1	Faint mark.	Never	—	Aunt with whom he lived and doctor.	After ailing.	—
XIII/32	240	18, Ellis Street -	W——, Barbara	F.	21	Housework -	Oct. 31	Oct. 28	Oct. 30	Oct. 31	Nov. 6	Confluent	Died at Hope Hospital.	Infancy	2	Good marks.	Never	—	Evidence of doctor.	Heart disease following acute rheumatism nine years ago.	—
II./23	245	Tanner's Lane -	N——, Peter -	M.	44	Cooper -	Oct. 31	Oct. 31	Oct. 31	Oct. 31	Nov. 7	Confluent	Died at Hope Hospital.	Infancy	—	"Marks"	Never	—	Daughter and sister-in-law.	Had drank heavily for years.	—
I./5	265	Frederick Street -	H——, Sarah -	F.	23	Housewife -	Nov. 5	Oct. 29	Nov. 5	Never	Nov. 21	Discrete	Died at home -	Infancy	3	Good marks.	Never	—	Doctor and mother	Pneumonia, October 21st; confined, November 3rd; small-pox, November 5th.	—
XV./21	322	62, Wellington Street.	G——, George -	M.	20	Pawnshop Apprentice.	Nov. 10	Nov. 3	Nov. 6	Never	Nov. 15	Confluent	Died at home -	Infancy	2	"Small marks."	Never	—	Mother - -	Healthy.	—
VIII./25	304	24, Pinners Brow -	W——, John -	M.	22	Engine tenter	Nov. 9	Nov. 4	Nov. 7	Nov. 9	Nov. 15	Confluent	Died at Hope Hospital.	Infancy	2	—	Never	—	Mother's evidence	Healthy.	—
XI./20	314	80, Longford Street	A——, Jabez -	M.	42	Foreman shunter.	Nov. 10	Nov. 5	Nov. 7	Nov. 14	Nov. 19	Confluent	Died at Hope Hospital.	Infancy	3	Good marks.	Never	—	Doctor and wife -	Alleged intemperance.	—
VII./6	324	62, Selby Street -	S——, Alfred -	M.	28	Journeyman blacksmith.	Nov. 10	Nov. 6	Nov. 9	Never	Nov. 15	Confluent	Died at home	Infancy	2	Small marks.	Never	—	Sister and ? doctor	Unknown - -	Unknown.
IX./3	344	77, Chorley Street -	E——, James -	M.	36	Engine-driver at forge.	Nov. 12	Nov. 6	Nov. 9	Never	Nov. 17	Confluent	Died at home -	Infancy	2	Good marks.	Never	—	Sister-in-law -	Reputed steady.	—
XII./12	365	3, Appleton Street -	S——, Percy -	M.	26	Boiler-maker	Nov. 16	Nov. 5	Nov. 10	Nov. 15	Nov. 20	Confluent	Died at Hope Hospital.	Infancy	2	Good marks.	Never	—	Doctor and mother	Drank heavily till within 12 months.	—

Table XIV.—*continued.*—Giving Particulars concerning all the VACCINATED Persons, 38 in number, who were certified to have DIED OF SMALL-POX May 10, 1892—May 10, 1893.

Book Reference.	No. of Case.	Residence.	Name.	Sex.	Age at Death.	Occupation.	Date of					Attack.		Primary Vaccination.			Re-vaccination.		Evidence as to Vaccination.	Previous Health.	Complications and Remarks.
							Notification.	Onset.	Rash.	Removal to Hospital.	Termination.	Type.	Result.	Date.	Marks.		Date.	Result.			
															No.	Character.					
XI. / 5	341	133, Winwick Road	G——, Sarah	F.	36	Housework	Nov. 11	Nov. 7	Nov. 11	Nov. 15	Nov. 19	Confluent	Died at Hope Hospital.	Infancy	3	Good marks.	Never	—	Doctor and husband.	Reputed weakly and ailing.	—
II. / 13	377	6, Mill Street	L——, James	M.	46	Hawker	Nov. 17	Nov. 13	Nov. 16	Nov. 18	Dec. 4	Confluent	Died at Hope Hospital.	Infancy	2	Very faint marks.	Never	—	Doctor and daughters.	Reputed not healthy; had formerly been in an asylum for 10 months.	—
XIII. / 9	388	44, Pierpoint Street	M——, William	M.	31	Ironworker	Nov. 21	Nov. 17	Nov. 20	Nov. 22	Nov. 29	Confluent	Died at Hope Hospital.	Infancy	2	Good marks.	Never	—	Doctor and mother	Reputed sober and healthy.	—
XIV. / 15	413	79, Buttermarket, Street.	E——, George	M.	39	Stonemason	Nov. 29	Nov. 26	None	Never	Nov. 29	Very malignant.	Died at home	Infancy	1	—	Never	—	Wife and sister-in-law.	Reputed to be a great sufferer from chronic bronchitis.	—
I. / 7	433	3, St. Mary Street	A——, John	M.	39	Book-keeper	Dec. 12	Nov. 29	Dec. 1	Never	Dec. 12	Confluent	Died at home	Infancy	1	Faint mark.	Never	—	Wife and sister	Reputed healthy and sober.	—
IX. / 4	468	79, Chorley Street	G——, Sarah	F.	62	Housework	Dec. 14	Dec. 9	Dec. 11	Dec. 14	Dec. 18	Confluent	Died at Hope Hospital.	Infancy	3	Very faint non. fov.	Never	—	All information concerning this case derived from Assistant Medical Officer of Health.	—	—
V. / 6	473	Workhouse, Guardian Street.	T——, James	M.	42	General labourer.	Dec. 19	—	Dec. 19	Dec. 19	Dec. 21	Confluent	Died at Hope Hospital.	Infancy	3	Good marks.	Never	—	Wife	Advanced pulmonary phthisis was real cause of death.	—
XVIII. / 2	550	31, Factory Lane	A——, James	M.	49	Assistant foreman.	Feb. 21	—	Feb. 19	Feb. 21	Feb. 23	Confluent	Died at Hope Hospital.	Infancy	2	—	Never	—	Death certificate	Alcoholic.	—
XIX. / 30	554	14, King Street	B——, John	M.	35	Cab-driver	Feb. 25	—	—	Feb. 25	Feb. 26	Malignant.	Died at Hope Hospital.	Infancy	1	Fov. IV.	Never	—	Assistant Medical Officer of Health.	Alcoholic	Died really of delirium tremens.
XVIII. / 19	607	54, Pierpoint Street	M——, John	M.	9	School	April 6	April 1	April 4	April 6	April 21	Confluent	Died at Hope Hospital.	Infancy	3	Small marks.	Never	—	Mother's evidence and copy of vaccination certificate from Penrith.	Was ill with inflammation of lungs and bowels at time of contracting disease.	Broncho-pneumonia.
XIX. / 12	636	103, Winwick Road	T——, Arthur	M.	40	Engine-fitter	April 26	April 24	April 26	April 26	April 27	Malignant.	Died at Hope Hospital.	Infancy	2	Faint marks.	Never	—	Death certificate and mother.	Reputed sober.	—
XVIII. / 10	640	93, Cartwright Street.	H——, Elizabeth	F.	24	Housework	April 28	April 24	April 26	April 28	May 6	Confluent	Died at Hope Hospital.	Infancy	2	Very plain marks.	Never	—	Death certificate	Delicate	Was suckling a child 18 months old, and milk ceased suddenly on admission to hospital.

Table XV.

Giving Particulars of all the UNVACCINATED Persons, 24 in number, who were certified to have DIED OF SMALL-POX, May 10, 1892 to May 10, 1893.

Book Reference.	No. of Case.	Residence.	Name.	Sex.	Age at Death.	Occupation.	Date of					Attack.		Evidence as to Vaccination.	Previou Health and Vaccination.	Complications and Remarks.
							Notification.	Onset.	Rash.	Removal to Hospital.	Termination.	Type.	Result.			
III. 1	1	Lodging house, Friar's Green.	R——, William	M.	27	Navvy	July 28	—	July 26	July 28	Aug. 5	Confluent	Died in Aiken Street Hospital.	Death certificate and brother.	Reputed intemperate.	Delirium.
VI. 6	10	8, Howard Street	B——, Henry	M	10	School	Aug. 23	Aug. 14	Aug. 17	Aug. 23	Aug. 26	Confluent	„ „	Death certificate and mother.	Good.	—
VI. 13	19	42, Howard Street	M——, James	M.	20 days	- -	Sept. 2	Aug. 29	Aug. 30	Never.	Sept. 6	Confluent	Died at home	Death certificate and mother.	„	—
XIII. 33	157	21, Allcard Street	G——, Robert	M.	1 month	- -	Oct. 10	Oct. 8	Oct. 8	Oct. 10	Oct. 12	Confluent	Died at Hope Hospital.	Mother	„	—
II. 17	182	2, Foundry Street	M——, Alice	F.	10 days	- -	Oct. 16	Oct. 11	Oct. 14	Oct. 17	Oct. 21	Confluent	Died at Hope Hospital.	Mother and father	Vaccinated October 11th on day of onset.	—
XIII. 7	260	36, Pierpoint Street	M——, Sarah	F.	8	School	Nov. 4	—	Oct. 20	Never.	Nov. 3	Confluent	Died at home	Mother and father	Unknown	This case was concealed and neglected by the parents, and was the subject of a coroner's inquest. Verdict "Death from "small-pox accelerated by neglect."
IX. 15	225	18, Forshaw Street	C——, Eliza	F.	39	House-work	Oct. 26	Oct. 23	Oct. 25	Oct. 26	Oct. 31	Confluent	Died at Hope Hospital.	Death certificate and mother.	Always weakly.	—
XV. 36	226	53, Howley Lane	R——, Mary	F.	43	House-work	Oct. 26	Oct. 22	Oct. 25	Oct. 25	Oct. 28	Confluent	Died at Hope Hospital.	Husband and death certificate.	Always ailing	"Secondary Hæmorrhage" death certificate.
VIII. 24	238	35, Pinner's Brow	R——, Thomas	M.	15	Tanner	Oct. 29	Oct. 27	Oct. 29	Oct. 29	Nov. 7	Confluent	Died at Hope Hospital.	Father and death certificate.	Good.	—
IX. 2	266	49, Chorley Street	J——, Jane	F.	38	Housework	Nov. 5	Nov. 4	Nov. 5	Nov. 5	Nov. 9	Confluent	Died at Hope Hospital.	Sister-in-law and death certificate.	—	—
X. 7	277	6, Watkin Street	H——, Martha	F.	28	House-work	Nov. 7	Nov. 4	Nov. 7	Nov. 7	Nov. 13	Confluent	Died at Hope Hospital.	Mother and death certificate.	"Never very strong."	—
I. 5	348	1, Frederick Street	H——, Annie	F.	10 days	- -	Nov. 13	—	Nov. 10	Never.	Nov. 14	Discrete	Died at home	Grandmother	—	—
VIII. 12	385	50, Turner Street	G——, William	M.	28	General labourer.	Nov. 21	Nov. 8	Nov. 11	Nov. 21	Nov. 23	Confluent	Died at Hope Hospital.	Wife and death certificate.	Good.	—
XIV. 27	372	2, Back Hopwood Yard	B——, William	M.	15 days	- -	Nov. 17	—	Nov. 15	Nov. 17	Nov. 22	Confluent	Died at Hope Hospital.	Mother and death certificate.	„	Born November 7th, and vaccinated 8th. Resulted in two good vesicles.
IV. 14	426	85, Cartwright Street	H——, Gladys	F.	1 month	- -	Dec. 2	—	Nov. 17	Never	Dec. 6	Confluent	Died at home	Mother and death certificate.	„	—

Table XV.—*continued.*

Giving Particulars of all the UNVACCINATED Persons, 24 in number, who were certified to have DIED OF SMALL-POX, May 10, 1892, to May 10, 1893—*continued.*

Book Reference.	No. of Case.	Residence.	Name.	Sex.	Age at Death.	Occupation.	Date of					Attack.		Evidence as to Vaccination.	Previous Health and Vaccination.	Complications and Remarks.
							Notification.	Onset.	Rash.	Removal to Hospital.	Termination.	Type.	Result.			
XV. 1	391	5, Dolman's Lane -	M——, Mary	F.	4	- - -	Nov. 23	—	Nov. 18	In Hospital.	Nov. 30	Confluent -	Died at Aiken Street Hospital.	Mother and death certificate.	Just recovering from scarlet fever.	—
XV. 8	390	39, Rose and Crown Street	M——, William	M.	3	- - -	Nov. 23	Nov. 18	Nov. 20	Nov. 24	Nov. 28	Confluent -	Died at Hope Hospital.	Mother and death certificate.	—	—
I. 12	451	139, Knutsford Road -	B——, Benjamin	M.	22	Butcher -	Dec. 7	Dec. 3	Dec. 5	Dec. 7	Dec. 18	Confluent -	Died at Hope Hospital.	Mother and death certificate.	"Fond of his glass": but not intemperate.	—
XV. 28	452	36, Ellesmere Street -	R——, Thomas	M.	35	Wood turner -	Dec. 7	Dec. 3	Dec. 7	Dec. 8	Dec. 10	Confluent Hæm.	Died at Hope Hospital.	Wife does not know. No marks were ever seen, or record traceable. Death certificate states unvaccinated.	—	—
XI. 13	461*a*	2, Hill's Yard -	E——, Mary -	F.	13 days	- - -	Dec. 12	—	Dec. 16	Dec. 12	Dec. 21	Confluent -	Died at Hope Hospital.	Mother and death certificate.	—	Vaccinated December 12th, three successful vesicles.
XV. 14	471	1, Diall's Mill -	C——, John -	M.	13 days	- - -	Dec. 16	—	Dec. 14	Dec. 16	Dec. 16	Confluent -	Died at Hope Hospital.	Mother and father -	—	—
V. 7	474	1, Knight's Yard -	T——, Henry	M.	17 months	- - -	Dec. 19	—	Dec. 19	Dec. 19	Dec. 21	Confluent -	Died at Hope Hospital.	Mother and death certificate.	—	Vaccinated December 15th.
XIV. 5	547	37, Scotland Road -	W——, John	M.	19	Negro vagrant	Feb. 13	—	—	—	Feb. 22	Confluent -	Died at Hope Hospital.	Death certificate states "no marks." Lodging-house keeper states not vaccinated.	Was reported to be covered with "syphilitic sores" before small-pox eruption came out.	—
XIX. 31	573	31, Golborne Street -	W——, Jane	F.	34	House-work -	Mar. 15	Mar. 13	Mar. 15	Mar. 15	Mar. 22	Confluent -	Died at Hope Hospital.	Patient herself and husband.	Good.	—

Sub-section c.—Analysis of Deaths.

Commentary on death.

Tables XIV. and XV. (pp. 29–33) give full particulars of all the fatal cases, 62 in number, occurring between May 10, 1892, and May 10, 1893, where small-pox was mentioned on the death certificate, grouped into vaccinated, 38, and unvaccinated, 24, persons, and arranged in order of date of eruption. Bearing in mind how much a single death may modify the case mortality of either group, great care has been taken to obtain the fullest information, and the results are here given. Some of the cases call for comment.

Vaccinated Deaths.

Causes of death.

Among the 38 vaccinated persons who died, eight had a markedly alcoholic history, and there is evidence to show as a matter of fact that three of these, numbers 98, 112, and 554, had suffered from delirium tremens before, and they probably died of this disease, the small-pox being but an accident.

Case 117, Thomas E——, æt. 18, did not have small-pox severely, and had been up and about for one or two weeks when he incurred a fresh disease of which he died. I have been unable to obtain any more particulars of this illness, but "small-pox—pyæmia" was given on his death certificate by the Assistant Medical Officer of Health. There is considerable doubt whether his death should be attributed in any degree to small-pox.*

Case 184, Jane H——, æt. 32, was suffering from puerperal septicæmia when she contracted small-pox.

In case 240, Barbara W——, æt. 21, cardiac valvular disease was a contributory cause of death.

Case 265, Mrs. H——, æt. 23, had recently been confined and was in a very critical condition, by reason of pneumonia, before ever she contracted small-pox from her mother, who was nursing her, and who brought the infection from another daughter suffering from unsuspected small-pox.

Case 473, James T——, æt. 42, was suffering from pulmonary consumption in a very advanced stage, and his death was not expedited by small-pox.

Case 607, John M——, æt. nine years and two months, was laid up with inflammation of the lungs and inflammation of the bowels at the time when he contracted small-pox, which latter, his doctor informed me, only played quite a subordinate part in the fatal issue.

In view of the above facts it seems doubtful if six cases (Nos. 117, 184, 265, 473, 554, and 607) ought to be included among the deaths from small-pox in vaccinated persons. Probably 98 and 112 ought also to be excluded if the information were a little more definite. Nevertheless they are all included among the vaccinated deaths.

Evidence as to vaccinated state.

None of these persons had ever been revaccinated. As regards the condition of their primary vaccination the best obtainable information has been procured. Generally this was pretty satisfactory, but in some instances (Nos. 12, 324, 344), it cannot be regarded as quite conclusive. In case 12, for example, the mother and doctor's evidence disagreed, but the circumstantial details given by the former caused the case to be included among the vaccinated persons. The date and place of his birth and vaccination being known, inquiry was made, but no records were available for that time. There was a similar discrepancy in case 607, but a copy of his vaccination certificate procured from Penrith, confirmed the mother's statement. In nearly all fatal cases the eruption is profuse and tends to hide the vaccination scars if they exist. Hence the doctors' or nurses' evidence "unvaccinated" if based solely on their own observation is less valuable than the doctor's statement "vaccinated." Such was probably the source of error which arose in case 473. If the pocks are very plentiful, or are situated over the vaccination scars, or when the congestion and induration of the skin, so characteristic of severe small-pox is present in large amount, then the plainest of scars, and certainly a faint one, is liable to be described as absent.

The Vaccination Registers are not always much help for several reasons. They have not always been as accurately posted and as safely preserved as they might be, especially in times gone by; and the law requiring their preservation was not in force till 1872. The Vaccination Register was consulted in every possible instance.

Without doubt the mother's affirmation "unvaccinated" is the best evidence we can possess in such cases. Motives for evasion of law may induce her to make a contrary statement, but there is no possible inducement for her to make this one, unless it be true; and in most instances she will, of her own accord, supply you with the extenuating reasons why the operation was not performed (*e.g.*, "'Cos we was wanderin' round the country"). Sometimes she can give you sufficient detail to judge whether the vaccination" took" or not. Fathers are not so reliable, though they are next best to the mother.

Other kinds of collateral and unskilled evidence have to be judged on their respective merits.

Cases 79 and 75. The brothers Peter and James L——, æt. 20 and 8 respectively, are very good illustrations of the difficulties which often beset an inquiry as to vaccination in fatal cases. For a long while I was assured on good authority that they were both unvaccinated persons. I was told that no record could be traced of their vaccination, and no marks could be seen during life. The death certificate, of which I procured a copy, contained the word "unvaccinated" in both cases. Both mother and father of these lads were dead, and those members of the family available could give me no definite information. I therefore included them, at first, in the unvaccinated class.

But some time later I succeeded in finding an older brother, who stated in general terms that he was sure all his brothers and sisters had been vaccinated except little Walter, another child who contracted the disease and recovered (case 80). This statement was confirmed by his Uncle Sam, and an old friend of his mother's. Next I sought an old friend and servant of the family, who said she always "thought Peter was vaccinated; but as to "Jimmy I used to see his maks thro' washin' 'im so often, "he had two good 'uns." Finally, I determined to search the vaccination register myself and found that against the name of Peter L——, who was born on May 26th, 1872, the vaccination entries were vacant, but against the name of James L——, who was born on April 12, 1884, was an entry of successful vaccination on August 22nd, 1884.

Peter, æt. 20, has therefore, in consequence of the conflict of evidence, been classed in the neutral group of doubtful vaccination (Class III.), but James, æt. 8, in view of the vaccination certificate and the servant's specific statement, has been included in Class II., in conformity with the definitions on p. 22, *ante*.

Unvaccinated Deaths.

Of 24 unvaccinated persons who died a large proportion were children, and only 19 of them were over 20 years old.

It will be observed that there were certain persons aged one month and under in the table of unvaccinated fatal cases. This is below the limit allowed by the existing law for the performance of vaccination (three months). By some observers, persons of one month old and under have been excluded in making a comparison of the vaccinated and unvaccinated classes respectively.* But I fail to comprehend the grounds for such exclusion. There were in all 34 babies aged 3 months old and less (*see* Table XXXIX., p. 54) living in the infected houses at the time of my inquiry. They formed units of the community under investigation, and I fail to see why they should be excluded from the statistical calculations. In this report persons of this age have been included whether they escaped or were attacked, whether they died or recovered, in whatever class to which they might happen to belong. It may be further added that during this epidemic the legal limit of age for vaccination was not regarded in that many babies were vaccinated at birth or a day or so later, so great was the scare.

The evidence of addiction to alcohol which I was able to discover in the unvaccinated cases 1 and 451 did not amount in my judgment to a contributory cause of death in either case. It existed to that extent in the majority of the townsfolk of that class, so far as I could judge (*see* p. 91, *post*).

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* I have since learnt from the Assistant Medical Officer of Health, under whose medical care he was, that his second illness was thrombosis of the lateral sinus, consequent on otitis media, which was followed by pyæmia, of which he died. The small-pox was wholly unconnected with the fatal issue.

* *e.g.*, Dr. Barry: Report on the Sheffield Epidemic, 1887–8, page 17.

Case 391 was recovering from scarlet fever, and this might have been thought a contributory cause of death. But seven other children who contracted the disease under precisely similar conditions (Table III., p. 12)—1 unvaccinated and 6 vaccinated—all recovered.

In case 547 I have given the lodging-house keeper's statement that he had a "syphilitic eruption," but the medical report of the case did not lead one to regard the eruption as anything more than phthiriasis; nor to consider that death was due to anything else than small-pox.

In case 260, æt. 8, the death according to the coroner's verdict was accelerated by the neglect of the mother. Both parents were intoxicated when I visited them at 10 o'clock one Sunday morning a month or two later.

As regards the non-vaccination of these 24 persons there are none which call for remarks beyond those appended in the column headed "Evidence as to Vaccination." If any doubt existed as to their being really unvaccinated persons they were not so included, but were placed in the "vaccinated" class, and therefore in Table XIV. It should be remembered that further information might have placed these latter cases among the unvaccinated.

Ages at Death.

The following Table (XVI.) gives the number of persons who died at the several age-periods among the vaccinated and unvaccinated cases respectively in Warrington 1892–3:—

TABLE XVI.

——	Number of Vaccinated Persons who died.	Number of Unvaccinated Persons who died.
1 month and under	—	8
1 month to 1 year	—	0
1 year to 2 years	—	1
2 years to 5 „	—	2
5 „ to 10 „	2	1
10 „ to 20 „	1	3
20 „ to 30 „	10	4
30 „ to 40 „	14	4
40 „ to 50 „	9	1
50 „ to 60 „	1	—
60 „ and upwards	1	—
Total	38	24

Average age amongst the unvaccinated fatal cases, 14·8 years.

Average age amongst the vaccinated fatal cases, 33·3 years.

It would seem as though vaccination influenced the *average age at death* from small-pox to an extent of an increase of 20 years.

Table XVII. gives the comparative fatality among the vaccinated and unvaccinated at different age-periods calculated from Tables on pp. 51 and 54. The re-vaccinated cases and those previously attacked by small-pox are excluded, leaving a balance of 654 cases.

TABLE XVII.

Age Period.	Vaccinated Cases—Per-centage Fatality.	Unvaccinated Cases—Per-centage Fatality.
Under 1 month	No cases.	100·0
1 month to 2 years	No cases.	25·0
2 years to 5 years	No deaths.	33·3
5 years to 10 years	6·6*	6·6
10 years to 20 years	0·6	16·6
20 years to 30 years	4·5	40·0
30 years to 40 years	12·8	66·6
40 years to 50 years	22·5	50·0
50 years to 60 years	5·9	No cases.
60 years and upwards	12·5	No cases.

* There were 30 cases, of whom 2 died, in the 5–10 years age-period. One of these deaths was case 607, John M——, referred to on page 34; the other was case 75, James L——, about whose vaccination there was some conflict of evidence (page 34). There were 15 unvaccinated cases, of whom one died in the 5–10 age-period.

A fatal Case of doubtful Small-pox.

The above are all the fatal cases in which small-pox was known to be present during life, or was mentioned in the death certificate as a cause of death.

It is necessary in conclusion to refer to a child who died at the age of 17 days.

This child formed the subject of special inquiry and report to this Commission on March 15th, 1893,† as an alleged death from vaccination. Here is an epitome of the case.

Percy S——* was an illegitimate infant born prematurely (8th month) on February 5th, 1893.

The child was small and feeble.

On February 6th the mother developed the eruption of small-pox, and was removed with her baby to the hospital on 7th.

On February 7th the child was vaccinated by the Medical Officer of Health (unsuccessfully) and again on 9th by the Assistant Medical Officer of Health (successfully).

On February 18th (9 days after successful vaccination) it is stated that about 10 pimples appeared on the body and face of the child, which subsequently "had a tendency to "become vesicular." (Assistant Medical Officer of Health.) No constitutional signs.

The baby got gradually weaker, and died on 22nd; death being certified by the Assistant Medical Officer of Health, as due to "premature birth—vaccination." This gentleman subsequently expressed to me the opinion that it had also suffered from small-pox during life; and that he had written to the Registrar-General with a view to amend his certificate of death.

This case would, in conformity with the definitions on p. 22 *ante*, have come in the columns of unvaccinated cases and deaths, and it can easily be added now. The evidence, resulting from very careful inquiry, is more fully recorded elsewhere.† But in view of the facts that various kinds of spots and rashes are so frequent in babies of this class, and that the symptoms of small-pox are usually so severe in persons at this age, the evidence did not appear to me to point conclusively to an occurrence of small-pox in this child.

In view of all the circumstances of this case the prime, indeed the only, cause of death was, in my judgment, asthenia, consequent on premature birth.

This case is not included in any of the tables of cases or deaths; nor is he included among the persons exposed.

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* There was another person of the same name, case 365, æt. 26, not to be confused with this one.

† Final Report of the Royal Commission on Vaccination, Appendix IX., Case 238.

SECTION IV.—COMPARISON BETWEEN THE EPIDEMIC OF 1773 AND THAT OF 1892–3.

Description of 1773 epidemic.

The powers of vaccination to protect from and modify small-pox should, if they exist, be evident in a comparison of the disease as it occurs in a vaccinated, and as it occurs in an unvaccinated community, other conditions being equal; or, if they also vary, sufficient allowance being made for them.

Now it happens that Warrington itself was the scene of a very severe outbreak of small-pox 120 years ago (in 1773) before the introduction of vaccination.

We have a valuable record of this outbreak by the Rev. John Aikin, published in the Philosophical Transactions for 1774. There is no reason for doubting the accuracy of the facts there revealed. The following particulars are extracted from that account, and also that published by Dr. Percival, F.R.S., in his "Essays."* As these and similar works are not, so far as I am aware, sufficiently known—and as people are thereby in danger of forgetting what an unmodified outbreak of small-pox is like—the following extracts, giving particulars of the epidemic, are here reproduced. Fortunately these two eminent authorities happened to be a resident and a native, respectively, of Warrington, and they took more than a passing interest in the health of the town. Dr. Percival practised in Manchester hard bye.

"*The Bill of Mortality of the Town of Warrington for the year* 1773. *By the Rev. J. Aikin. Communicated by Dr. Percival to the Royal Society of London.*†

"The town of Warrington, by the best account yet procured, contains between 1,600 and 1,700 houses. At five persons to a house, which is supposed a sufficient allowance, as but few are occupied by more than one family, this will give somewhat above 8,000 for the number of inhabitants.

"The average of yearly marriages, christenings, and burials, registered in the Parish Church from 1750 to 1769 inclusive, is : Marriages 73, christenings 237, burials 199. That for the years 1770, 1771, and 1772 is : Marriages 95, christenings 331, burials 258.

* * *

"The melancholy overbalance of burials, which now appears, plainly arises from the dreadful ravages of a single disease, the small-pox, which perhaps has seldom raged with greater malignity than in its late visitation of this town. Its victims were chiefly young children, whom it attacked with such instant fury that the best directed means for relief were of little avail. The state of the air went through all possible variations in the course of it, but with no perceptible difference in the state of the disease. In general, the sick were kept sufficiently cool, and were properly supplied with diluting and acidulous drinks; yet where they recovered it seemed rather owing to a less degree of malignity in the disease or greater strength to struggle with it, than any peculiar management.

"Where it ended fatally, it was usually before the pustules came to maturation; and indeed in many they showed no disposition to advance after the complete eruption, but remained quite flat and pale.

"The gradual progress and decline of the disease will appear from the table of months. Its proportional virulence began to abate considerably before it ceased. I cannot with certainty lay down the general proportion of deaths; but in one neighbourhood I found that out of 29 who had the disease, 12 died, or about 2 in 5; in others the mortality was still greater, and I have reason to believe it was not less on the whole. It may perhaps be worthy of observation that the proportion of females who died, to males, was nearly as three to two.

* * *

"WARRINGTON, 1773. BILL OF MORTALITY.

General Bill.

Marriages 93. Births, males 175, females 181, total 356. Deaths, males 223, females 250, total 473.

Table of months of year 1773.

—	Total Deaths.	Small-pox.
January - - - - - - -	39	4
February - - - - - - -	34	4
March - - - - - - -	48	13
April - - - - - - -	52	23
May - - - - - - -	83	63
June - - - - - - -	71	49
July - - - - - - -	49	33
August - - - - - - -	27	11
September - - - - - - -	20	7
October - - - - - - -	14	3
November - - - - - - -	6	0
December - - - - - - -	30	1
Total - - - - -	473*	211

"TABLE OF DISEASES which caused the Deaths in 1773.

Aged - - - - -		32
Asthma - - - - -		3
Chincough - - - - -		16
Casualties - - - - -		5
Childbed - - - - -		5
Consumption, under 14 - -	24	96
,, 14 to 45 -	36	
,, above 45 - -	36	
Convulsions - - - - -		34
Dropsy - - - - -		13
Fever - - - - -		15
Inflammation of the bowels - - -		2
Measles - - - - -		1
Mortification - - - - -		1
Palsy - - - - -		7
Quinsey - - - - -		1
Scrophulous swelling - - -		1
Small-pox - - - - -		211
Soon after birth - - - -		6
Suddenly - - - - -		6
Teething - - - - -		7
Worm fever - - - - -		10
Unknown - - - - -		1
		473

The following extract is from "Essays Medical, Philosophical, and Experimental," by Thomas Percival, M.D., F.R.S. 2 vols. London and Bristol, 1789, *p.* 71 *et seq.*

"In the year 1773, the small-pox raged with great violence in the town of Warrington, and I have procured from my friend Mr. John Aikin an exact account of the number and ages of those who died of it."

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* "Essays, Medical, Philosophical, and Experimental," by Thomas Percival, M.D., F.R.S. 2 vols. Printed in Warrington, 1788, and London, 1789.

† Published in Philosophical Transactions for the year 1774. Vol. 64.

* Probably includes Nonconformists, see footnote * right-hand column of p. 38.

“DEATHS by the Small-pox at Warrington in 1773.

Table of Ages.

	Numbers who died of Small-pox.
Under 1 month	0
From 1 to 3 months	4
Over 3 and under 6 months	6
,, 6 ,, 12 ,,	39
,, 1 ,, 2 years	84
,, 2 ,, 3 ,,	33
,, 3 ,, 4 ,,	18
,, 4 ,, 5 ,,	15
,, 5 ,, 6 ,,	4
,, 6 ,, 7 ,,	2
,, 7 ,, 8 ,,	2
,, 8 ,, 9 ,,	4
Total	211”

There are two striking features in this table—

1. There were no deaths from small-pox over 9 years of age. Probably most of the older people had been protected by an attack in early life.
2. That nearly nine-tenths of the deaths (184 out of 211) in 1773 were under 4 years of age. In 1893, 272 vaccinated persons under 4 years were exposed to infection in the infected houses, and not one of them even contracted the disease.

The following Extract is from Dr. Percival's contribution to the Philosophical Transactions, Vol. LXIV., p. 439.

“The comparative mortality of the small-pox at Manchester, Warrington, and Chowbent in the different seasons of the year, may be estimated by the following table :—

—	Manchester from 1768 to 1774.	Warrington. 1773.	Chowbent. from 1767 to 1773.	Total.
January, February, March	160	21	17	198
April, May, June	137	135	7	279
July, August, September	147	51	2	200
October, November, December.	145	4	1	150
Total	589	211	27	827

“Sydenham has observed that the small-pox when it is mild and regular, usually commences about the vernal equinox, in those years in which it is epidemic, but that it begins earlier when it is of an irregular and more dangerous kind.

“No one can doubt that variations in the moisture, dryness, temperature, and other qualities of the air must influence a disease, which is always of an inflammatory, and often in its last stages of a putrid nature. But the progress of it cannot be regulated by the seasons, because it is derived from contagion ; the communication of which frequently depends upon accident, is confined to no period of time, and is varied by its degrees of malignity. During the last visitation of the small-pox at Warrington, the state of the atmosphere went through all possible changes, but with no perceptible difference in the circumstances of the disease.”

At foot of this page is a table (XVIII.) summarising the main features of the two epidemics, 1773 and 1893.

The ravages of small-pox in 1773 may justly be regarded as appalling. There were 473 persons of all ages died during that year, and of this number little short of half (211), *all under 9 years of age*, died of a single disease, in a population estimated at 8,000. It was further believed that nearly one-sixteenth of the population were attacked by the small-pox. Even during the cholera epidemic in Warrington of 1832 I noticed, while searching the Parish Church Register, that there were only about 146 deaths from that disease in a population estimated at 16,600.

In order to examine this epidemic more closely let us inquire into—

(*a*.) *Social and Hygienic Condition of the Inhabitants in* 1773.

I have been at great pains to discover, with the help of the British Museum authorities and Mr. Madeley of the Warrington Free Library, the social condition of the Warrington folk at that time.*

They seem to have been a comparatively simple-minded people in those days, occupying what was then practically only a village situated on the river Mersey, from the clear and abundant waters of which they caught salmon. Now it is a sluggish, highly-polluted stream in which no fish can live.

Their chief business was sail-making, a healthy and cleanly occupation. The iron and metal manufactures are mentioned in 1795, but had not taken root in 1775.

The people lived chiefly out of doors ; and so far as I can gather from old records, they lived healthier lives than in the present day.

Perhaps the people were not quite so intelligent then, though I have no information on this particular point, but it is hard to imagine that it were possible for them to be more lacking in a rudimentary knowledge of cleanliness,

TABLE XVIII.

GIVING a COMPARATIVE SUMMARY of the leading features of the SMALL-POX EPIDEMICS of 1773 and 1893 in Warrington.

—	In the Year 1773. Small-pox unmodified by vaccination or inoculation.	In the Year 1893. (May 10, 1892 to May 10, 1893). Small-pox modified by Vaccination.
Population	8,000*	54,084
Number of cases of small-pox	510*	667
Number of deaths from small-pox	211†	62
Average age of fatal cases of small-pox	2½ years	Vaccd. 34 yrs. Unvaccd. 14 yrs.
Death-rate per 1,000 inhabitants from small-pox.	26·4	1·1
Number of deaths from all causes *other than* small-pox.	262	1,217
Proportion of small-pox deaths to deaths from all causes per cent.	44·7	5·4

* These are figures estimated by Rev. J. Aikin, all the rest are actual figures.
† All under nine years of age.

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* “Description of country round Manchester,” by J. Aikin, M.D., published in London, 1795. “A six months' tour through the North of England,” by Arthur Young, 4 vols., London, 1770. Dr. Thos. Percival, F.R.S., “Works, Literary, Moral and Political.” 2 vols. Bath, 1807 Rev. J. Aikin, loc. cit. ; and “A glance at the History of Warrington,” by an Inhabitant, 1860.

the management of their children, and similar health conditions than their descendants were when I visited them from house to house in 1893.[*]

The position of the town was the same, and the general surroundings of the people, so far as they are known in the present day to affect small-pox, were as a whole no worse than they are now; in a word, the two communities are comparable as regards social and health conditions. If either gains by the comparison it is the older one.

Small-pox was certainly regarded as a catching disorder; both Aikin and Percival tell us so. In some other parts of the country at that time, no doubt, inoculation of small-pox was practised to a considerable extent, but at Warrington Mr. Aikin reckons that there were not more than 10 persons who had been inoculated. It may safely be assumed that his figures concern natural small-pox unmodified in any way. The possible confusion of small-pox with measles and other diseases is dealt with on p. 39.

Small-pox is not a disease over which medical treatment, at least modern medical treatment, has any influence, and it is interesting to learn from Mr. Aikin's account that the same fact was realised in 1773, *only simple cooling measures being adopted.*

(*b.*) *An examination of the causes of death other than Small-pox in* 1773.

In 1773 there were 262 deaths[*] in Warrington from different causes, excluding the 211 registered as small-pox, and this gives, with a population, as estimated by Mr. Aikin, of 8,000, a death-rate of 32·75 per thousand of the population compared with 24·6 in 1891,[†] when there was no small-pox, a difference of 8 per thousand in the course of 120 years.

This is not a very remarkable difference when one bears in mind the phenomenal improvement which has taken place in all kinds of medical treatment during that epoch of time and the almost complete disappearance of typhus fever.

Table XIX. (given at foot) shows a comparison between the different causes of mortality in these periods respectively.

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[*] Their present social condition is further referred to in Part IV. of this Report.

[*] This probably includes Nonconformists, for I find on inspection of the Parish Church Register, which has been kept up ever since the 16th century, that the total deaths in the Church Register only amount to 455 or 18 short of the official lists of mortality (473). It would seem probable, therefore, that these 18 came from the Nonconformists.

[†] This year has been taken as the latest when all the necessary figures were available. It has the additional advantages of having had no small-pox.

TABLE XIX.

SHOWING the COMPARATIVE MORTALITIES and several CAUSES of DEATH, other than SMALL-POX, grouped into Classes somewhat comparable with each other, occurring in the Years 1773 and 1891 respectively.

Causes of Death in **1773** as per Bill of Mortality.[*]	Number.	Total.	Number of Deaths in 1891 from same Group of Causes divided by 6·6.[†]	Causes of Death as registered at the District Registrar's Office, **1891.**	Number.	Total.	—
A.—Consumption, under 14 - -	24			A.—Phthisis - - - -	73		
„ 14 to 45 - -	36			Diseases of respiratory system	308		
„ above 45 -	36						
Asthma - - - -	3	99	58			381	
B.—Measles - - - -	1			B.—Measles - - -	80		
Fever - - - -	15			Scarlet fever - - -	9		
Inflammation of the bowels -	2			Typhus - - - -	1		
"Worm fever" - - -	10			Enteric fever - - -	13		
Quinsey - - - -	1	29	23	Simple and ill-defined fever -	—		
				Diarrhœa and dysentery -	41		
				Diphtheria - - -	11		155	
C.—Dropsy - - - -	13			C.—Diseases of the circulatory system.	68		
"Suddenly" - - -	6	19	10			68	
D.—Palsy - - - -	7			D.—Diseases of the nervous system	139		
Convulsions - - -	34			Cancer - - - -	29		
Aged - - - -	32			Whooping cough - -	19		
Mortification - - -	1			Diseases of digestive system -	79		
Chincough - - -	16			Diseases of the urinary „ -	19		
Unknown - - -	1			Disease of the generative „ -	7		
		91	144	All other causes - -	348	640	
E.—Childbed - - - -	5			E.—Puerperal fever - -	1		
		5		Childbirth - - -	3	4	
F.—Casualties - - -	5	5	7	F.—Violence (inquests) - -	47	47	
G.—Soon after birth - - -	6			G.—Tabes mesenterica - -	17		
Teething - - - -	7			Other tubercular and scrofulous diseases.	43		
Scrofulous swelling - -	1	14	1			60	
Total deaths from all causes excepting small-pox - - - -		262	—	Total deaths from all causes excepting small-pox - - - - -		1,355	—
Total deaths from all causes excluding small-pox and respiratory diseases -		163	=20·4 per 1,000	Total deaths from all causes excluding small-pox and respiratory diseases -		974	=18·3 per 1,000

[*] Rev. J. Aikin, Phil. Trans. 1774.

[†] Because the population in 1773 (8,000), was 6·6 times less than it was in Midsummer 1891 (53,000).

It is extremely difficult to compare the causes of death registered at such distant periods of time, but the registered causes have been grouped so as to make them more comparable. It will be seen that the discrepancy between the death-rate of 1773 and that of 1891 may virtually be accounted for by the difference in the deaths certified as "consumption" and "asthma" on the one side, and "phthisis" and "respiratory diseases" on the other; diseases which are, perhaps, more likely to have been correctly registered than the others, and which, moreover, are not considered preventible diseases, except in a climatic sense.

If these deaths be excluded from both sides it will be seen that the death-rates of the two periods are very similar. The death-rate of Warrington in 1773 from diseases other than respiratory diseases and small-pox was 20 per 1,000 inhabitants, living. The death-rate of Warrington in 1891 from diseases other than respiratory diseases and small-pox was 18 per 1,000 inhabitants living.

The two communities (Warrington in 1773 and in 1893) may therefore be fairly taken as comparable from a social and hygienic point of view; but in the one no inhabitants had been vaccinated, whereas in the other all the inhabitants, excepting a small fraction, had been vaccinated in infancy, of whom a similarly insignificant fraction had been vaccinated since infancy.

(*c.*) *Attack rate from Small-pox in* 1773.

1. From the actual figures before us (211 known *deaths* in a population of 8,000, and 667 known *cases* in a population of 54,000) it is obvious that the attack rate of 1773 was more than double that of 1893 (26·0 and 12 per 1,000 population living), even on the extreme supposition that every person attacked died of the disease in 1773, and not excluding the unvaccinated persons and cases from the 1893 epidemic.

2. But Mr. Aikin states that in one district, at least "12 "in every 29 attacked died." The number of deaths is known, and consequently it may be estimated that 510 persons were attacked in the population of 8,000, an attack-rate of 64 per 1,000 in Warrington (1773) as compared with an attack-rate of 11 per 1,000 in the vaccinated Warrington, 1892–3.*

3. Finally, it will be seen from a history of the prevalence of small-pox in Warrington (Sub-section *f*) that the disease which had been endemic in the town up to the year 1853, when the practice of vaccination was first made compulsory by the State, thenceforth became only epidemic.

(*d.*) *Severity and Fatality of Small-pox in* 1773.

1. It seems a very reasonable question to ask—Did all these 211 children really die of small-pox, in view of the fact that this disease is apt to be mistaken for measles at that time of life; and, when the little patients sometimes die before the pustular stage is reached? There is, moreover, an undoubted tendency during the medical overwork of an epidemic for deaths to be set down to a prevailing disease which do not belong to that category; although small-pox is not easy to mistake, and was seen so much in those days.

Now among the diseases separately classed in the last century and mentioned on the preceding page (Table XIX., left-hand column), "Fever," "Worm-fever," and Measles are probably the only ones which would have had to be sorted out from the 211 small-pox deaths. And if deaths from these causes had to any extent been included in the 211, the death-rate from these causes during the year 1773 would probably be less than that of other years. I have therefore collected from the bills of mortality the death-rates from these several causes through a series of years, and embodied them in Table XIX*a*., p. 42.

As regards measles, it will be seen that the death-rate in 1773 was somewhat *below* the average death-rate from that disease at that epoch, and also below the average in the present day—being 0·12, 0·65, and 0·412 per 1,000 respectively. It is, therefore, possible that a few deaths from Measles were included in the 211, possibly about six deaths, which would bring the death-rate of 1773 up to the average at that epoch. On the other hand the Death-rate from "Fever" and "Worm-fever" in 1773 was a little above the average death-rate from those causes (3·1, average 2·02). But, even if it be assumed that six or a few more deaths from Measles were in error included among the deaths from Small-Pox, it would not very considerably modify the heavy mortality from Small-Pox among the people of Warrington in 1773.

Medical men must have been perfectly familiar with these two diseases in those days, and the probable error was not likely to have been very great.

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* Thus, from Table XII., p. 28, it will be seen that, if the 68 unvaccinated cases be excluded, there is a remainder of 599 cases of small-pox; and in sub-section *b*, p. 24, *ante*, we have seen that in the total population of 54,084 in the summer of 1892, there probably existed ·8 per cent. of unvaccinated persons, leaving a residue of 53,651. Having thus excluded the unvaccinated cases and the unvaccinated persons from the respective groups, the attack rate was 11 per 1,000.

TABLE XX.

SHOWING NUMBER of PERSONS who DIED of SMALL-POX, at all and at certain Ages in Warrington in 1773 and 1893 (May 10th, 1892, to May 10th, 1893) respectively.

Ages.	Persons who died of Small-Pox.			——
	1773.*	1893. Vaccinated Deaths.	1893. Unvaccinated Deaths.	
1 month and under - - - -	—	—	8	
From 1 to 3 months - - -	4	—	—	
" 3 " 6 " - - -	6	—	—	
" 6 " 12 " - - -	39	—	—	
" 1 " 2 years - - - -	84	—	1	
" 2 " 3 " - - - -	33	—	—	
" 3 " 4 " - - - -	18	—	1	
" 4 " 5 " - - - -	15	—	1	
" 5 " 6 " - - - -	4	—	—	
" 6 " 7 " - - - -	2	—	—	NOTE.—Average age at death in 1773 = 2½ years. Average age in 1893, = 26 years. Average age in vaccinated, 1893, = 33 years. Average age in unvaccinated, 1893, = 14 years.
" 7 " 8 " - - - -	2	—	—	
" 8 " 9 " - - - -	4	1	1	
" 9 " 15 " - - - -	—	1	1	
" 15 " 20 " - - - -	—	1	2	
" 20 " 25 " - - - -	—	6	1	
" 25 " 30 " - - - -	—	4	3	
" 30 " 35 " - - - -	—	6	1	
" 35 " 40 " - - - -	—	8	3	
" 40 " 45 " - - - -	—	6	1	
" 45 " 50 " - - - -	—	3	—	
" 50 " 55 " - - - -	—	—	—	
" 55 " 60 " - - - -	—	1	—	
" 60 " 65 " - - - -	—	1	—	
Total - - - -	211	38	24	
		Total -	62	

* From particulars supplied by Rev. John Aikin, and published by Dr. Percival in his "Essays." (*See* p. 37 *ante*.)

Case-mortality.

2. We have no record of the severity of the cases in 1773, nevertheless, Mr. Aiken, who seems to have studied the outbreak with great care, tells us "that out of 29 who had "the disease 12 died, or about 2 in 5." This would give a case-mortality of 40 per cent. It does not differ very largely from the case-mortality among the unvaccinated in our day (68 cases, 24 deaths, *35 per cent.*).

Mean annual mortality from small-pox in 1773.

3. The death-rate from small-pox in Warrington in the year 1773 was *26·4 per 1000* (211 in a population of 8,000). The death-rate among the vaccinated inhabitants of Warrington in 1893 was *·6 per 1,000*, 38 in a vaccinated population of 53,654 (deducting ·8 per cent. unvaccinated from 54,084).

(*e.*) *Age Incidence.*

But the most striking fact in the comparison of the epidemics of 1773 and 1893 is the age at which small-pox was fatal, as shown in Table XX. (p. 39 *ante*).

It will be seen that there were no deaths in 1773 over nine years of age, the very age at which the vaccinated deaths in 1893 commence.

It will also be seen that the average age at death from small-pox in Warrington 1773, was 2½ years; and in Warrington 1893, 26 years, or excluding those dying unvaccinated in 1893, the average age at death was 33 years.

If we take the small-pox deaths in decades of age, as in Table XXI. (at foot), it would seem, from a comparison of cols. A. and B., that vaccination shifts the age period of maximum number of deaths onward, from the first decade to the fourth decade of life.

This important causal connection receives confirmation from the fact that the same decade (the first) is the one chiefly affected among the unvaccinated in 1893. And this latter comparison (of cols. B. and C.) deals with persons living side by side under precisely the same conditions, excepting as regards their having being unvaccinated or vaccinated respectively.*

In perusing Table XXI. (at foot) it is important to bear in mind (*a*) that the former endemic prevalence† of this infantile scourge, afforded protection to, at all events, a very large proportion of those living in 1773 at the older ages, for many of them had had the disease; and (*b*) at a later epoch, (say 1853–1883), the endemic prevalence had disappeared, and therefore the protection thus afforded by previous attack to persons from 10 to 40 years of age in 1893, had disappeared.

The inference from the comparison between the two epidemics is that the practice of vaccination has favourably modified the small-pox so as to lessen the death-rate from that disease in the population 24 times, and to shift the chief age period of death from the disease forward from the first to the fourth decade of life (see also Table on p. 51).

(*f.*) *The prevalence of Small-Pox in Warrington at different periods of time between* 1773 *and* 1891.

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Warrington has frequently had small-pox among its inhabitants; indeed, this town has hardly ever escaped whenever it has been prevalent in the middle or north of England, probably on account of its position on the high road to and from Manchester, Liverpool, Birmingham, and other large towns.

It will therefore be interesting to examine a list of the different years when deaths from small-pox occurred, so far as is known (Table XXII., next page).

We have an accurate record of the year 1773*, and, with comparatively few exceptions, of the years 1791 and onwards, contained in the bills of mortality preserved in the Warrington Free Library.

It is evident from these records that small-pox was endemic in the town of Warrington from 1773 (and earlier) up to 1851.

The following extracts from the writings of Dr. Daniel Moss, are interesting as showing the prevalence of the malady and its effect on infantile mortality. It is apparent also from these that small-pox was not absent during the years 1774–1790, although the records of this interval are missing. Dr. Daniel Moss was a doctor practising in Warrington, and from a thesis in the Warrington Free Library it appears that he took his degree at Glasgow. He drew up the Bills of Mortality for the Authorities, and it is from his "Observations" appended to the Bills for 1791–92† that the following extracts are taken.

"Infant deaths everywhere swell the gloomy lists of mortality, especially in cities and larger towns, which are in a peculiar degree fatal to them. In London and all the great capitals of Europe, upon an average, one half of the children born, die under two years of age. In country towns and villages the proportion of infant mortality greatly decreases. In Manchester half the children born die under five years of age; but were the ravages of small-pox prevented by any means, the number of deaths under that period would not fully amount to one in four" (25 per cent.).

"During the year of 1790, when two principal epidemics prevailed, namely, the small-pox and putrid fever, which swept away a considerable number of inhabitants, the total burials was less than the births by eleven."

"The circumstance that hath occurred to raise the list of deaths of the present bill so much higher than that of the preceding, must be solely ascribed to the natural small-pox, as the mortality from other causes is diminished. This epidemic (the scourge of the human race) prevailed for the most part during the year 1792, though not to the extent or with the malignity we have before experienced. As it made a complete progress through the town in 1790, there were comparatively few subjects capable of receiving the infection. From this, as well as the facts in our former bills, it appears that the spread of small-pox at a place depends solely upon the number of people liable to take it, and not upon any peculiar state of the air."

TABLE XXI.

—	A. Unvaccinated Deaths, 1773.	B. Vaccinated Deaths 1893.	C. Unvaccinated Deaths 1893.
0–10 years - - - - -	211	2	12
10–20 " - - - - -	0	1	3
20–30 " - - - - -	0	10	4
30–40 " - - - - -	0	14	4
40–50 " - - - - -	0	9	1
50–60 " - - - - -	0	1	0
60–70 " - - - - -	0	1	0
Total - - -	211	38	24

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* The facts here revealed correspond very precisely with those elicited by Dr. R. J. B. Cunninghame, as regards Edinburgh, and already submitted to the Commission, (Sixth Report, p. 642.) In that town out of 2,300 deaths from small-pox during the years 1764–83, all but 17 occurred in persons under 10 years of age. Whereas, 100 years later (1864–83) a larger number of deaths from small-pox occur over 15 years of age than under that age.

† *See* next sub-section *d.*, and also quotation from Dr. Percival's essays *ante*.

* Rev. J. Aikin, *loc. cit.*

† Preserved in the Warrington Free Library.

CHRONOLOGICAL SUMMARY of SMALL-POX DEATHS in WARRINGTON, 1773 to 1891.

Table XXII. below reveals the following points:—

1773.—Natural small-pox endemic to the town.

1773 to 1842.—Total number of deaths from small-pox known to have occurred in 30 of these years, of which records exist, 1,039. *Average* 35 *per annum.*

1843–54.—Total deaths from small-pox during 12 years, 132. *Average* 11 *deaths per annum.*

1855 to 1867.—Small-pox ceases to be endemic in Warrington. Total deaths from small-pox during 13 years, 81. *Average. six deaths per annum.*

30 and 31 Vict. cap. 84 (1867).—Vaccination made more efficiently compulsory.

(January 10, 1872, Mr. Wm. Harrison appointed the first Vaccination Officer at Warrington under the Act of 1871.)

1868–91.—24 years. Total deaths from small-pox, 63. *Average of two deaths per annum.*

There is no reason for doubting the authority of the records above quoted, but it should be remembered that prior to 1839 the records do not exist for every consecutive year. In the meantime the population of Warrington has steadily grown from 8,000 to 53,000. The number of deaths per annum from small-pox *diminishes* seventeen and a half times, although the population *increases* six and a half times.

TABLE XXII.

GIVING PARTICULARS concerning the prevalence of SMALL-POX in WARRINGTON, 1773 to 1891.

The columns of deaths from 1794 to 1845 only include those deaths registered in the parish church.

Year.	Total Number of Inhabitants in that Year.	Total Deaths from all Causes.	Deaths from Small-Pox in that Year.
1773	8,000*	473*	211†
1791	10,000 (estimated)	286	10‡
1792	10,100	314	52‡
1794	10,200	319	68‡
1795	10,300	314	46‡
1796	10,500	441	92‡
1797	10,600	248	20‡
1801	11,300	421	54‡
1807	12,000	322	1‡
1810	12,700	396	74‡
1818	14,000	476	5‡
1820	14,500	320	7‡
1821	14,600	349	14‡
1822	14,700	339	29‡
1823	15,000	426	28‡
1825	15,200	347	17‡
1826	15,400	524	32‡
1827	15,600	439	24‡
1828	15,800	400	17‡
1829	16,000	486	21‡
1832	16,600	559	33‡
1833	16,800	531	28‡
1834	17,000	579	8‡
1835	17,200	436	2‡
1836	17,400	489	77‡
1837	17,600	661	14‡
1839§	18,200	545	5‡
1840	18,400	468	18‡
1841	18,600	517	26‡
1842	19,000	584	6‡
1843	19,300	486	2‡
1844	19,600	483	2‡
1845§	19,800	457	3‡
1846	—	615	40
1847	—	1,011	27
1848	—	571	1
1849	—	617	2
1850	—	561	0
1851	22,894	597	53
1852	—	571	2
1853	—	644	0
1854	—	644	
1855	—	555	0
1856	—	562	0
1857	—	698	0
1858	—	610	1
1859	—	565	30
1860	—	581	1
1861	25,953	736	0
1862	—	635	0
1863	—	1,198	1
1864	—	801	17
1865	—	743	31
1866	—	1,106	0
1867	—	746	0
1868	—	828	0
1869	—	875	15
1870	—	983	10
1871	32,144	901	5
1872	—	768	15
1873	—	803	0
1874	—	895	5
1875	—	948	1
1876	—	876	1
1877‖	—	907	0
1878	—	905	8
1879**	37,000	982	0
1880	40,000	823	0
1881	41,456	841	1
1882	42,600	1,037	0
1883	43,814	947	0
1884	44,482	943	0
1885	45,408	838	0
1886	46,343	982	0
1887	47,264	1,122	0
1888	47,464	980	2
1889	49,000	1,084	0
1890	50,068	1,133	0
1891	52,743	1,339	0

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* Bill of Mortality of Warrington, Phil. Soc. Trans. 1774.

† All these deaths occurred under 9 years of age, and mostly in April, May, and June. Three-fifths of all who died were females.

‡ Bills of Mortality published in Warrington for the authorities of the Parish Church.

§ Up to this year the number of inhabitants have been estimated from the number of inhabited houses; subsequently the figures are from the Registrar-General's returns.

‖ Fever Hospital established this year, 1877.

** Compulsory notification adopted, 1879. The figures from here to end are from the reports of the Medical Officer of Health for Warrington.

SECTION V.—ON THE CHARACTER OF VACCINATION SCARS.

The existence of characteristic vaccination marks is undoubted evidence of previous vaccination; but, as doubt may be thrown on the value of the size, texture, and other characters of the scars as a means, in general terms, of estimating the efficiency of the operation and its alleged protective power, it may be well to examine this question.

In measuring the vaccinated condition of persons concerned in this epidemic, the definitions set forth at the commencement on page 22 were strictly adhered to.

a. Statistical evidence derived from this epidemic.

As regards protection from Attack, it will be seen from Table IX. (p. 26, *ante*) that there were rather more "well vaccinated" (63 per cent. as compared with 61 per cent.), persons to be found in the uninfected than in the infected houses. Moreover, an inspection of Table X. (page 27), shows that, out of 2,535 persons exposed to infection in the infected houses, a larger proportion of the "indifferently vaccinated," 27 per cent., were attacked than of the "well vaccinated," 21 per cent.

And Table X. (p. 27, *ante*) also shows, in reference to the measure of *modifying* power, that the case mortality amongst the "doubtfully vaccinated" (40 per cent.), was considerably higher than amongst the "indifferently vaccinated" (9 per cent.); and this was higher than that amongst the "well-vaccinated" (3 per cent.).

b. Exceptional instances.

Very early in the inquiry I was, on visiting infected houses, struck with the fact that out of several persons equally exposed to infection in an infected house, those with good marks (measured as stated) sometimes contracted the disease, while those with bad ones escaped; and again of two persons who contracted the disease, living under the same conditions of life, and apparently the same in all respects, a "well-marked" person might incur a very severe, while the one with bad marks would incur a mild attack.

The following are illustrative instances of what I mean.*

1. *Case 49* (Annie C——), æt. 18 (*see* photograph 1) represents the arm of a girl who developed a severe attack of confluent small-pox on September 5th 1892, and was nursed at home with three other occupants of the house for 10 days after the appearance of the eruption. Her face is very badly, pitted. The patient's vaccination scars are very perfect ones, according to current views; three scars making an aggregate of 1½ square inches completely foveate area. The marks of the other members of the family, æt. 42, 41, and 22 respectively, are small, faint, and imperfect, very faintly foveate, and considerably under an aggregate of ½ square inch each. None of the household had been vaccinated since infancy. Thus the most recently vaccinated and the best marked person in the household contracted the disease badly, and the rest escaped.

2. Three cases of small-pox occurred in a respectable family of nine persons, all vaccinated in infancy, but never since until after the house became infected. None had ever had small-pox before.

Jare (case 175), æt. 17, eruption October 14, very mild small-pox, had far the best vaccination marks of the household. She had three large entirely foveate marks measuring about 1 × ⅝ inch, a total area of 2·262 square inches.

William, æt. 19, eruption, October 29th, severe confluent small-pox, had three foveate marks, ·282 square inch, together covering ·846 square inch.

Mary, æt. 24, eruption, October 30th, confluent small-pox. His arm bears five marks, two foveate ones, measuring ·126 square inch each, and three plain ones, measuring each ·126 square inch; total vaccinated area ·630.

These three persons were the three best vaccinated in the house, and were all over ½ square inch in area, ranking as first class.

The other six members of the family were:—Thomas, æt. 23—2 foveate ·282 = ·564 square inch. George, æt. 13—3 foveate ·126 = ·378 square inch. The father, æt. 59—1 foveate = ·282 square inch. Arthur, æt. 7—2 foveo-cicatrical ·126 = ·252 square inch. The mother, æt 54—1 plain = ·196 square inch. Harriet, æt. 16—hardly discernible and unmeasurable (? 3).

The source of infection to the first case, Jane, was a patient next door, who was treated at home all the while. The source of the other two was either the case next door or their sister Jane, All the family lived much together, were all very healthy, and *Mary* and *Harriet* worked side by side as packers at a chemist's. None of them held more communication with their neighbours than speaking to the wife of the patient across the garden wall: they were not on intimate terms. The whole family were surrounded by identically the same conditions, excepting differences of age.

It follows therefore—

1. The best marked in this household was the first to contract the disease, exposure to infection as far as could be traced being equal.
2. That the worst vaccinated person entirely escaped infection.
3. That out of nine persons the three "best vaccinated" contracted the disease, they all ranking as very first class vaccinations. The exposure to infection was probably the same in all.
4. That the six who escaped were all inferior to the other three, five of them being only up to the standard of indifferent vaccination as measured by current doctrines.

These instances have been mentioned because, meeting them all at one time, and early in the inquiry, I was very nearly led thereby into drawing conclusions on insufficient grounds and without allowing for sources of error.

The texture of the vaccination scar as we see it in the adult may have been modified by several conditions.

The foveation of vaccination scars does but follow the same laws which govern other lesions involving only the superficial layers of the skin, such as the pitting after a burn on the arm of M. R., the child of case 276, photograph 2, opposite. Here the pitting or foveation simply indicates the contraction of the dermal papillæ, and in all such scars the foveation varies considerably with the lapse of time.

The rate of growth, or rather subsidence, of all scars is an unknown factor, but they all tend to become obliterated as age advances, and vaccination marks are no exception to this law.

This is doubtless a reason why a larger proportion of indifferently vaccinated persons is to be found in the later decades of life (*vide* Tables V. and VI., page 23, and XXXI., page 49).

The character and size of the scar may also, it is conceivable, depend on the surroundings and state of health of the child at the time of vaccination—conditions on which the amount of suppuration and scar formation in any individual so much depend.

In a person also who gets fat, the stretching of the skin produces obliteration of the marks, as in the mother, æt. 47, of case 82.

All these are fallacies which were difficult to avoid, and I did not in this inquiry find the texture of the vaccination scar an invariable test of the efficiency of the vaccination; although I carefully grouped the different qualities of texture as mentioned on p. 22.

In conclusion, as regards *the size* of the cicatrices, the statistical facts of this epidemic seem to show that the aggregate area of the scars left by vaccination is in some degree a measure of the protection afforded.

From the data before me there are, however, no means of differentiating the character of *foveation* or texture as a measure of protection apart from the *size* of the marks.

The texture of revaccination scars is only occasionally foveate. There seems also a tendency for them to become less so, and also smaller after repeated revaccinations.

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* Nos. 171, 195, 37, 150, 259, 262, 456, 445, 320, 327, 136, 627, 614, 555, 95, 53, 121, 185, 50, 84, 2, 276*a*, 140, 109, 145, might also be regarded as instances.

TABLE XIX*a*.

Showing DEATH-RATE from MEASLES and WORM-FEVER per 1,000 PERSONS living.—Referred to on p. 39.

—	Death-rate for Warrington. Figures derived from the Bills of Mortality (*see* Table XXII., p. 41) for 1773 and the next nine years during which they have been preserved.										Death-rate for the whole of England. Annual Report of Registrar-General: Supplement 1885, p. 112.		
	1773.	1791.	1792.	1794.	1795.	1796.	1797.	1801.	1807.	1810.	10 years, 1851–60.	10 years, 1861–70.	10 years. 1871–80.
Deaths from "Measles" per 1,000 persons living - - -	0·12	0·20	0·29	0·58	1·00	1·33	—	0·35	0·50	1·49	0·412	0·440	0·378
Deaths from "Fever" and "Worm-Fever" per 1,000 persons living - - -	3·1	1·4	1·5	1·3	2·4	2·7	1·6	—	2·0	2·2	—	—	—

NOTE.—Average death-rate from Measles in Warrington during 10 of the years, 1773–1810 = 0·65 deaths per 1,000 persons living; ditto in all England, 1851–1880 = 0·412 per 1,000. Average death-rate from "Fever" and "Worm-Fever" in Warrington during 10 of the years, 1773–1810 = 2·02 deaths per 1,000 persons living.

ROYAL COMMISSION ON VACCINATION.

Dr. SAVILL'S REPORT ON THE WARRINGTON SMALL POX EPIDEMIC 1892-3.

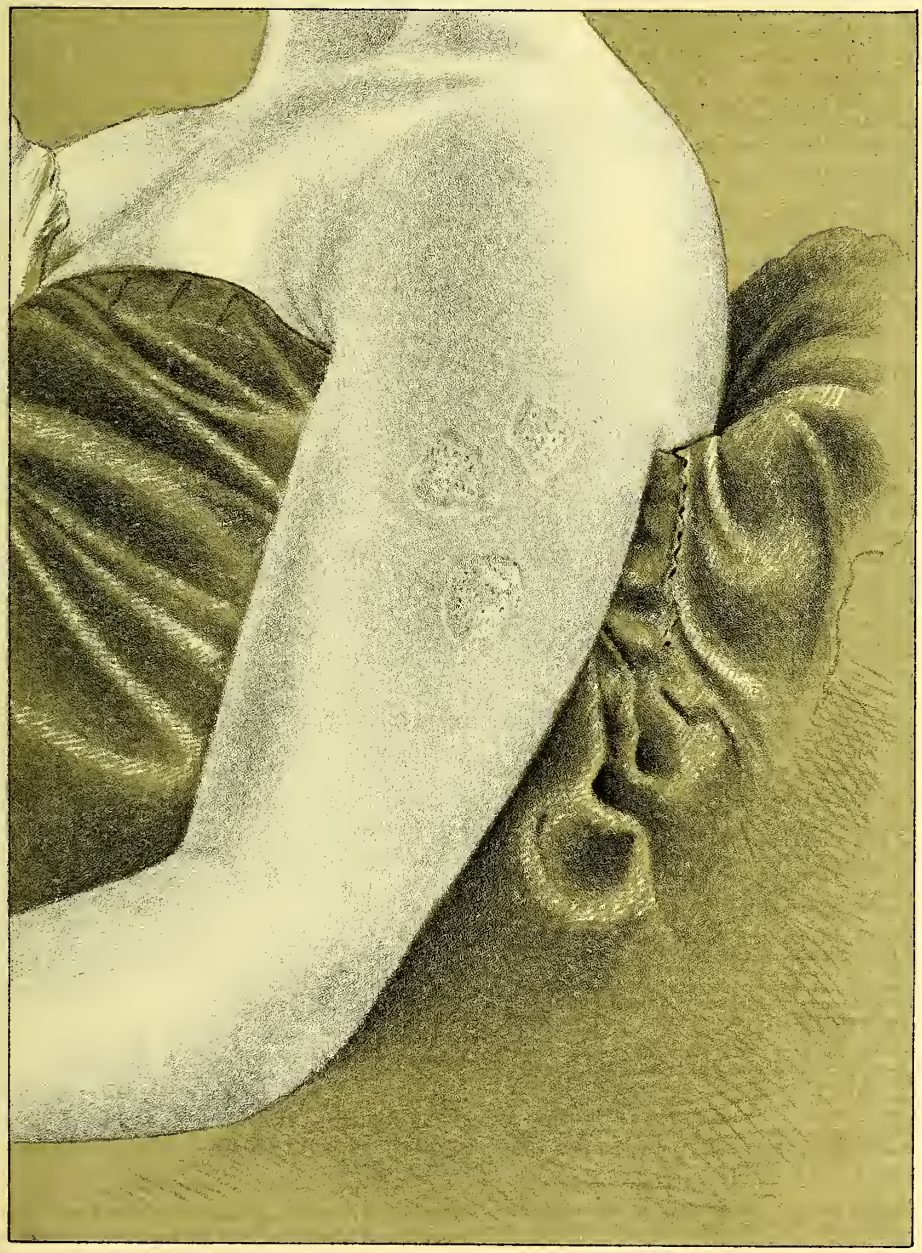

Photo 1. Arm of Annie C——, æt. 18, (Case 49), Confluent Small-pox; showing three typically foveate scars, the result of vaccination in infancy. Total area 1½ square inches.

Photo 2, p. 42.

ROYAL COMMISSION ON VACCINATION.

Dr. SAVILL'S REPORT ON THE WARRINGTON SMALL POX EPIDEMIC 1892-3.

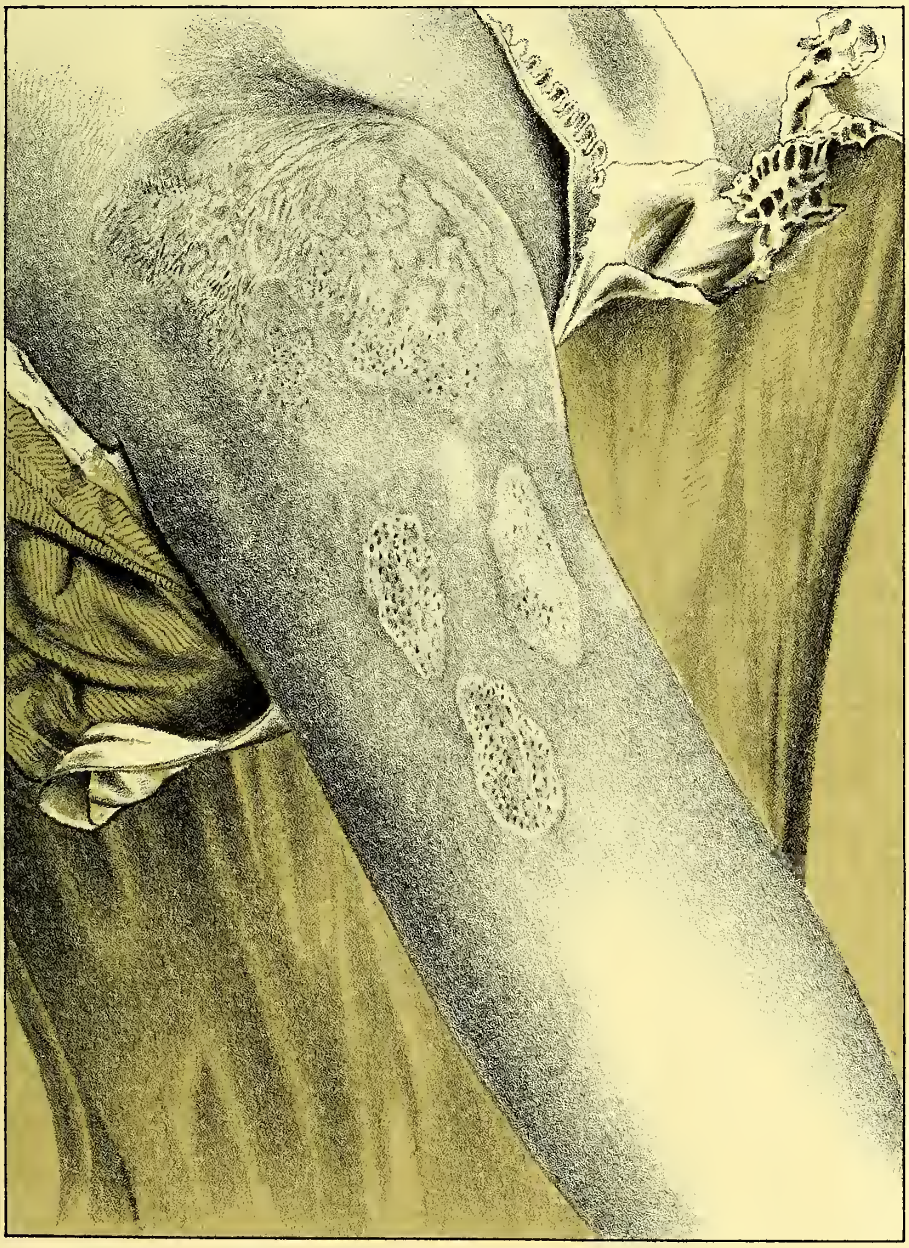

Photo. 2. Arm of Mary R ——, æt. 10 (daughter of Case $276\frac{11}{7}$)
To show the similarity of foveate texture in a scar resulting from a superficial burn on shoulder. 8 years before, and in the scars of vaccination in infancy, 10 years before the date of the photograph (June 1893).

SECTION VI.—THE INFLUENCE OF RE-VACCINATION ON SMALL-POX.

Hitherto we have dealt only with primary vaccination in its relation to small-pox. It will now be necessary to ascertain what influence, if any, re-vaccination had on the Warrington epidemic.

(*a.*) *Re-vaccinated Condition of Town in August* 1892.

There were no means of ascertaining the precise number of re-vaccinated persons in the whole of Warrington at the commencement of the outbreak. But if the Aikin Street area (p. 24, *ante*) may be taken as representing the whole town, there were only 2·7 per cent. who had been vaccinated twice or oftener during their lives.

There were reasons for believing that in the whole town considerably less than this proportion had been re-vaccinated prior to the large outbreak. Many persons in the Aikin Street area, included in the 2·7 per cent., had been re-vaccinated during the scar consequent on the small preliminary outbreak in May, between that date and August 1892, because of the proximity of Aikin Street to the hospital. And as regards the whole town, the Public Vaccinator informed me that only 34 persons were re-vaccinated at the public vaccination station during the seven years, July 1885 to July 1892.

The same gentlemen states that nearly 17,000 persons were known to have been re-vaccinated from July 1892 to March 1893 inclusive. 881 were done at the usual public vaccination station, Golborne Street; 1,482 at the five stations specially established by the Corporation; and 14,539 by private practitioners, mostly workpeople at the expense of their employers; all during the progress of the epidemic.

The various provisions made for re-vaccination will be found on p. 20, *ante*.

(*b.*) *Re-vaccinated State of Infected Houses.*

In investigating the re-vaccinated condition of the infected houses, an inmate has been counted as re-vaccinated who had been successfully operated on more than 14 days prior to the appearance of the eruption on the patient in the house; taking 14 days as the period of inoculation of small-pox.* Persons re-vaccinated within that limit of time will be dealt with subsequently (p. 45).

Attack-rate. There were 63 re-vaccinated persons dwelling in houses invaded by small-pox, and of these, 7, or 11·1 per cent. were attacked† (*i.e.*, excluding 1 who had previously had small-pox).

This is the lowest attack-rate among any of the "vaccination classes," and, as will be seen from an inspection of Table X. (p. 27), it is lower than the attack-rate amongst persons who had priviously had small-pox, for 12·2 per cent. of these latter developed small-pox a second time.

(*c.*) *Re-vaccinated Cases of Small-Pox.*

The annexed table (Table XXIII.) gives particulars of the only successfully revaccinated persons who contracted small-pox during the epidemic; eight in number.

Two of these persons call for comment,—

1. The remarkable case of a woman (No. 620), Mary M———, æt. 30, who was vaccinated in infancy (½ in foveate area), was successfully revaccinated in 1873, æt. 10 (½ in foveate area), had small-pox about, probably at, the same time, and finally contracted a severe attack of confluent small-pox in April 1893, which resulted in her face being badly pitted. Interval of 20 years between re-vaccination and small-pox a second time.

2. A man (No. 295), Jno. A———, æt. 37, who lived in one of the lodging-houses, vaccinated in infancy (⅓rd in non-foveate area) again in 1870, æt. 15 (⅓rd in non-foveate area), contracted discrete small-pox in November 1892. Interval of 22 years between re-vaccination and small-pox. This man is excluded from the estimation of the attack-rate among the revaccinated for reasons given at foot of Table X., p. 27.

None of these eight cases died.

Length of interval. The several intervals between the re-vaccination and the small-pox were—7 years, 8 years, 15 years, 20 years, 22 years, 25 years, and 27 years. Thus it will be seen that the shortest interval was seven years.

(*d.*) *On the Power of Re-vaccination to protect from Infection.*

The re-vaccinated cases of small-pox are too few to draw any conclusion as regards its power to *modify* the disease over and above the power which primary vaccination is alleged to possess; but, in addition to the facts just

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* Vide Introduction.

† Table X., p. 27, *ante*. The workhouse, fever hospital, 4 common lodging and 14 other houses being excluded for reasons there stated.

TABLE XXIII.

The EIGHT CASES of SMALL-POX occurring among 2,535 Persons, living in 437 Infected Houses, who had been successfully Re-vaccinated more than 14 days before developing the Eruption.

No. of Case.	Book and Page.	Name and Age.	Primary Vaccination.	Date of Re-vaccination.	Result of Re-vaccination.	Date of Small-pox Eruption.	Type of Small-pox.	Result.	Interval between Re-vaccination and Small-pox.
491	$\frac{\text{IX.}}{14}$	B——, William, 42 - -	Infancy. 1 fov. II. ·282 sq. in. "Indiff. vacc."	1866 æt. 15.	Success - -	2nd Jan., 1893	Confluent	R.	27 years.
446	$\frac{\text{VII.}}{20}$	B——, Annie, 26 - -	Infancy. 2 fov. $\frac{\text{IV.}}{2}$ ·408 sq. in. "Indiff. vacc."	1873 æt. 6.	2 fov. $\frac{\text{IV.}}{2}$ -	6th Dec., 1892	Discrete -	R.	20 years.
439	$\frac{\text{XV.}}{25}$	H——, Chas., 38 - -	Infancy. 2 fov. $\frac{\text{IV.}}{2}$ ·408 sq. in. "Indiff. vacc."	1867 æt. 13.	2 fov. $\frac{\text{IV.}}{2}$ -	3rd Dec., 1892	" -	R.	25 years.
349	$\frac{\text{IX.}}{12}$	I——, Eliza, 38 - - -	Infancy. 3 fov. II. ·846 "Well vacc."	1884 æt. 30.	2 success. -	10th Nov., 1892	Mild	R.	8 years.
138	$\frac{\text{XV.}}{3}$	K——, Jas., 25 - - -	Infancy. 1 f. fov. IV. ·126 sq. in. Indiff. vacc.	1877 æt. 10.	1 w. fov. II. -	4th Oct. 1892 -	Discrete -	R.	15 years.
143	$\frac{\text{V.}}{13}$	D——, Herbert, 26 - -	Infancy. 3 fov. III. ·588 Well vacc.	1885 æt. 19.	3 success. No marks.	2nd Oct., 1892	Mild -	R.	7 years.
295	$\frac{\text{XIV.}}{6}$	A——, John, 37 - -	Infancy. 3 non. fov. IV. ·378 sq. in. "Indiff. vacc."	1870 æt. 15.	Successful. 3 non-fov. IV.	8th Nov., 1892	Discrete -	R.	22 years.
620	$\frac{\text{XVIII.}}{19}$	M——, Mary, 30 - -	Infancy. 1 fov. II. ·282 sq. in. Indiff. vacc.	1873* æt. 10.	1 fov. I.	18th Apr., 1893	Confluent	R.	20 years.

* Also suffered from small-pox at that time. *See* text above.

mentioned, there are certain other facts in the Warrington epidemic which point to the efficacy of revaccination as *protecting from infection*.

1. As we have seen, the attack-rate in the infected houses amongst these re-vaccinated was less than the attack-rate amongst those who had been protected by a previous attack of small-pox. The figures in Table X. (p. 26) in both columns are certainly small, but the similarity of the per-centages is a point worthy of note.

2. It is a fact of some importance that not one of all the 667 cases of small-pox had been successfully revaccinated more recently than seven years prior to the epidemic.

3. The only 2 members of the Aikin Street Hospital staff who were not re-vaccinated at the commencement of the outbreak were the only members of the staff who contracted small-pox.

4. The following are some instances where there exist reasons for believing that prompt *re-vaccination probably prevented spread* of the disease in an infected household.

Case 589 (f., æt. 18) was the only one of a family of eight persons who refused re-vaccination. All but this girl, the two youngest (æt. 2 and 5) had been re-vaccinated before the house became infected.

Case 624 (m., 23) similarly refused re-vaccination in November 1892. Six others of the family, all over 11 years of age, were done then and escaped, although two of them slept with the patient after the eruption came out.

Case 377 lived under very adverse hygienic conditions, and was one of a household of 16, ranging in age from 2 to 45 years. He was at home three days with the eruption out. All those (nine) over eleven were successfully re-vaccinated on the day the patient was removed, and no other member was subsequently attacked.

Cases 70, 175, 318, 444, 467, might also be mentioned as probable instances of the same efficacy.

5. Re-vaccination was performed extensively in the principal "Works" in the town, mostly at the expense of the employers, and in many the disease diminished or ceased to occur.

The works where the largest number of cases arose were the Dallam and Bewsey Ironworks (2,075 employees). During the 2nd and 3rd weeks of November it is estimated by Dr. Adams (the Medical Officer to the works) that some 1,400 or 1,500 of the men were re-vaccinated under circumstances already mentioned (p. 20, *ante*). The accompanying Table XXIV. shows the weekly number of men who developed the eruption, and it will be seen that there was a very considerable drop in the number of cases during and after the first and second weeks in December, *i.e.*, 14 days after re-vaccinations were performed. Indeed, only 12 cases occurred subsequently to the latter period of time, and up to May 10, and I was informed by the medical officer of health that these were men who had either refused re-vaccination or joined subsequently. The outbreak amongst these workmen, and the cause of the large number in week November 12, is dealt with more fully on p. 75.

6. *Troops.*—An average of 300 regulars and 200 militia are stationed at Warrington, and reside in the barracks at the north-east corner of the town. By the army regulations *all* recruits to the *regular troops* are re-vaccinated on joining; though *militia recruits*, the surgeon in charge informed me, are not re-vaccinated unless their marks are imperfect. In addition to these, 80 women and about 213 children reside in barracks, whose vaccination regulations are the same as for militiamen, making some 800 persons in all. At the time of the epidemic an inspection was made by the surgeon in charge, and re-vaccination performed wherever the original marks were reported not good.

Only one case of small-pox occurred (October 10, 1892), among these 800 persons, a militiaman,* whose primary marks were good, and who had not, therefore, ever been re-vaccinated. This gives an attack rate of ·12 per cent. in this well *re*-vaccinated community, as compared with 1·2 per cent. in the town generally.

Nor were any cases reported from the Police, nor in the Postal Service, in both of which re-vaccination was extensively practised either before or during the panic.

7. All the Aikin Street Hospital who were re-vaccinated escaped small-pox; but the two who were not re-vaccinated contracted the disease (p. 11).

Sub-section (*e*).—*Unsuccessful re-vaccination does not, as is sometimes believed, imply immunity from small-pox as the following list* (*Table XXV.*) *tends to show.*

The first of these cases was re-vaccinated at the Dallam and Bewsey forge with the other men, the lymph used being, Dr. Adams informed me, Renner's stored in tubes. The second and third were done at the Public Vaccination Station, and they were done by the Public Vaccinator, who generally uses the same lymph. The fourth person was admitted to the Small-pox Hospital by an error in diagnosis on March 15th, and was re-vaccinated on 17th and 19th by the Assistant Medical Officer of Health, both times with Renner's lymph in tubes. He left the hospital on March 30th, and developed the small-pox eruption on April 1st.

TABLE XXIV.

NUMBER of PERSONS working at the Dallam and Bewsey Forge who developed the eruption of small-pox each week.

Week ending	Cases notified from Dallam and Bewsey Forge.
August 27	2
September 3	2
" 10	0
" 17	0
" 24	1
October 1	1
" 8	3
" 15	4
" 22	4
" 29	4
November 5	3
" 12	36
" 19	4
" 26	5
December 3	1
" 10	1
" 17	0
" 24	1
" 31	2
January 7	1
" 14	0
" 21	0
" 28	1
February 4	0
" 11	0
" 18	0
" 25	0
During March	2
During April	5
To May 10, 1893	0
Total	83

TABLE XXV.

FOUR CASES of SMALL-POX unsuccessfully Re-vaccinated more than 14 days before the Eruption.

No. of Case.	Book and Page.	Name and Age.	Primary Vaccination.	Date of Re-vaccination.	Result of Re-vaccination.	Date of Small-pox Eruption.	Type of Small-pox.	Result.
639*a*	$\frac{\text{XVIII.}}{10}$	H——, Wm., 25	Infancy, 1 fov. II., ·282 sq. in., indifferently vaccinated.	Nov. 1892	Unsuccessful	12th April	Mild	R.
87	$\frac{\text{V.}}{23}$	H——, Alice. 35	Infancy, 3 fov. II., ·846, well vaccinated.	Sept. (?10) 1892	"	24th Sept. 1892	"	R.
78	$\frac{\text{IV.}}{9}$	M——, Sarah, 13	Infancy, 4 good, "well vaccinated."	1891 æt. 11	"	21st Sept. 1892	"	R.
574*a*	$\frac{\text{XIV.}}{33}$	B——, Joseph, 35	Infancy, 2 fov. III. ·392 sq. in., indifferently vaccinated.	March 17th and 19th, 1893	"	1st April 1893.	Discrete	R.

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* J. G——, æt. 19, a mild case. He was isolated in the Army Hospital within the barracks. No secondary cases arose from this patient.

SECTION VII.—THE EFFECTS OF CONCURRENT VACCINIA AND VARIOLA ON EACH OTHER; THE EFFECT OF A PREVIOUS ATTACK OF VARIOLA ON VACCINIA; AND THE EFFECT OF A PREVIOUS ATTACK OF VARIOLA ON VARIOLA.

(a.) Concurrent Vaccinia and Variola.

In the course of this inquiry certain instances have come to my notice which seem to bear on these questions; and first—Sub-section (a.) *Do Vaccinia and variola, being concurrent, have any reciprocal action on each other?*

The following Table (XXVI.) gives a list of such cases:—

TABLE XXVI.

CASES of SMALL-POX occurring in PERSONS who had been SUCCESSFULLY or UNSUCCESSFULLY VACCINATED or RE-VACCINATED 14 days or less before the Eruption, arranged in order of interval between the Vaccination and the appearance of the Eruptions.

No. of Case.	Book and Page.	Name.	Age.	Date of Primary Vaccination.	Character of Primary Vaccination.	Date of Re-vaccination.	Result of Re-vaccination.	Date of Small-Pox Eruption and interval after Re-vaccination.	Type of Small-Pox.	Result.
80	II./4.	L——, Walter	5	Unvaccinated until 20th Sept. 1892.			Successful	Sep. 21—1 day after	Confluent	R.
192	XI.	H——, Faith	36	Infancy	2 veryfaint II.	16th Oct. 1892	Successful	Oct. 18—2 days after	Mild	R.
35	VI./9	W——, Maria	8	Unvaccinated until 5th Sept. 1892.			1 faint IV.	Nov. 7—2 „	Severe Discrete.	R.
282	VII./17	W——, Joseph	26	Infancy	3 faint marks	4th Nov. 1892	2 successful	Nov. 7—3 days after	Mild	R.
375	V./22	S——, Jas.	21	Infancy	2 fov. II./III.	12th Nov. 1892	Successful	Nov. 15—3 „	Mild	R.
384	VIII./6	P——, Florence	34	Infancy	1 fov. I.	13th Nov. 1892 21st Nov. 1892	2 successful	Nov. 24—3 days	Confluent	R.
182	II./17	M——, Alice	b. Sept.	Unvaccinated until 11th Oct. 1892.			Unknown	Oct. 14—3 „	Confluent	D. Oct. 21
461A	XI./13	E——, Mary	b. Dec. 8, '92.	Unvaccinated until 12th Dec 1892.			3 successful	Dec. 16—4 days	Confluent	D. Dec. 21
474	V./7	T——, Henry	17 months	Unvaccinated until 15th Dec. 1892.			3 good vesicles	Dec. 19—4 „	Confluent	D. Dec. 21
406	XI./14	M——, Jas.	20	Unvaccinated until 17th Nov. 1892.			3 good -	Nov. 21—4 ,	Confluent	R.
398	XII./11	R——, Thos.	17	Infancy	2 fov. IV.	17th Nov. 1892	2 large marks	Nov. 23—6 days	Mild	R.
393	VIII./15	W——, Mary	36	Infancy	2 wk. fov. II.	15th Nov. 1892	2 large vesicles	Nov. 21—6 „	Discrete	R.
174	IV./12	W——, Martha	24	Infancy	2 marks	7th Oct. 1892	Unsuccessful	Oct. 13—6 „	Mild	R.
428	XI./17	C——, John	23	Unvaccinated until 22nd Nov. 1892.			Successful	Nov. 28—6 „	Discrete	R.
21	VI./6	B——, John	37	Infancy	2 good	24th Aug. 1892	Successful	Aug. 31—7 days	Mild	R.
516	VIII./28	W——, Frank	26	Infancy	2 fov. II.	11th Jan. 1893	Successful	Jan. 18—7 „	Mild	R.
467	XIV./13	C——, Eliz.	43	Infancy	2 fov. I.	6th Dec. 1892	2 good vesicles	Dec. 13—7 „	Discrete	R.
372	XIV./27	B——, Wm.	15 days	Unvaccinated until 8th Nov. 1892			2 successful	Nov. 15—7 „	Confluent	D. Nov. 22
16	V./20	L——, Agnes	48	Infancy	2 faint II.	23rd Aug. 1892	Successful	Aug. 31—8 days after.	Mild	R.
67	IV./4	S——, Annie	22	Infancy	1 fov. II.	14th Sept. 1892	Unsuccessful	Sept. 22—8 days	Confluent	R.
394	VII./6	T——, Mary	25	Infancy	2 good	12th Nov. 1892	Successful	Nov. 20—8 „	Very mild	R.
234	XI./7	N——, Arthur	24	Infancy	3 fov. III.	18th Oct. 1892	2 successful	Oct. 26—8 „	Mild	R.
651	XIX./2	O'B——, John	2	Unvaccinated until 2nd May			Successful	May 10—8 „	Mild	R.
432	XIII./2	B——, Ruth	24	Infancy	3 fov. III.	24th Nov. 1892	3 successful	Dec. 2—8 „	Very mild	R.
520	VIII./28	D——, Annie	28	Infancy	3 fov. I.	11th Jan. 1893	2 very typical vesicles.	Jan. 19—8 „	Discrete	R.
434	XV./9	L——, Mary	32	Infancy	1 fov. II.	22nd Nov. 1892	2 successful	Nov. 30—8 „	Mild	R.

Table XXVI—*continued.*

No. of Case.	Book and Page.	Name.	Age.	Date of Primary Vaccination.	Character of Primary Vaccination.	Date of Re-vaccination.	Result of Re-vaccination.	Date of Small-Pox Eruption.	Type of Small-Pox.	Result.
643	XX. 7	F——, John -	33	Infancy	1 wk. fov. I.	20th April -	2 successful -	April 29—9 days after.	Semi-confluent.	R.
403	X. 11	B——, Kate -	25	Infancy	1 fov. I. -	15th Nov. 1892	1 successful -	Nov. 24—9 days after.	Mild -	R.
395	X. 12	P——, Margaret -	31	Infancy	2 fov. II. -	15th Nov. 1892	2 good vesicles	Nov. 24—9 days after.	Very mild	R.
252	I. 2	B——, Joseph -	25	Infancy	3 times, but did not take.	23rd Oct. 1892	3 good vesicles	Nov. 1—9 days after.	Mild -	R,
549	V. 25	S——, Percy* -	b. Feb. 5th	Unvaccinated until		7th Feb. 1893 - 9th Feb. 1893 -	Uusuccessful Successful -	Feb. 18—10 days after.	Very mild	D. Feb. 22
509	XIII. 21	G——, Kate -	35	Infancy	4 fov. III. -	5th Jan. 1892	3 good vesicles	Jan. 15—10 days after.	Discrete -	R.
442*a*	XV. 25	H——, Annie -	30	Infancy	2 f. fov. III.	23rd Nov. 1892	2 successful vesicles.	Dec. 3—10 days after.	Mild -	R.
256	V. 3	B——, Sarah -	28	Infancy	2 f. fov. III.	22nd Oct. 1892	Unsuccessful -	Nov. 1—10 days after.	Mild -	R.
200	XI. 2	H——, Frank -	4	Unvaccinated until 9th Oct. 1892.			Successful -	Oct. 19—10 days after.	Semi-confluent.	R.
56	V. 12	C——, Hannah -	10	Unvaccinated until 29th Aug. 1892			2 fov. II. -	Sept. 9—11 days after.	Discrete -	R.
421	VIII. 35	T——, Sarah* -	b. Nov. 18	Unvaccinated until		1st Dec. 1892 - 4th Dec. 1892 -	5 successful -	Dec. 13—12 days after.	Very mild	R.
488	I 8	W——, Eliz. -	36	Infancy	2 non-fov. IV. very faint.	15th Dec. 1892	Unsuccessful -	Dec. 29—14 days after.	Very slight	R.
574*a*	XIV. 33	B——, Jas. -	35	Infancy	2 fov. III. -	17 & 19th Mar.	Unsuccessful -	April 1—13 and 15 days after.	Discrete -	R.

* It seems very doubtful if these two cases suffered from small-pox. They are separately described on page 35 and below.

Remarks on Table XXVI.

Precise particulars as to kind of lymph and operator could not be obtained in all of these cases, but there seemed no reasonable doubt on this score. Many were done by the Public Vaccinator when he visited the infected house in his capacity of Medical Officer of Health. In all cases the lymph was nearly sure to be fresh.

The inference which this table suggests is that if vaccination be performed less than 12 days before the expected appearance of the small-pox eruption, it does not necessarily prevent an attack. Nor is there anything to show decisively that concurrent vaccinia modifies the course of the disease. It is true that in the first 10 cases of Table XXVI. there were 3 mild, 1 severe discrete, and 6 confluent; and in the next 22 (omitting unsuccessful cases), there were 4 very mild, 10 mild, 5 discrete, 2 semi-confluent, and 1 confluent. But it is also true that in the first group 6 of the cases were previously unvaccinated, while in the last group most of the cases had been vaccinated in infancy.

Conversely, there is nothing to show that the presence of the variolous poison within the system, during its period of incubation, in any way modifies the course of the vaccinia. The cases are not numerous, but they tend to show that, in order to be really efficacious as a preventive of small-pox, vaccination or re-vaccination must be performed not less than 12 days before the expected appearance of the small-pox eruption.

It will be seen from this table that—

4 cases developed the eruption of small-pox 7 days after successful vaccination or revaccination.

7 cases developed the eruption of small-pox 8 days after successful vaccination or re-vaccination.

4 cases (1 semi-confluent and 3 mild) developed the eruption of small-pox 9 days after successful re-vaccination; not including the doubtful case of S——, who had a few "pimples" on 9th day after successful vaccination. (See p. 35.)

2 cases developed the rash of mild and discrete small-pox 10 days after successful re-vaccination; and

1 case developed the rash of semi-confluent small-pox 10 days after successful primary vaccination,

1 case developed the rash of discrete small-pox 11 days after successful primary vaccination.

No one developed the eruption of small-pox 12 or more days after vaccination or re-vaccination, unless the infant (S. T.——), about to be mentioned, is to be regarded as a case of small-pox.

Included in Table XXVI. are two infants believed to have had abortive small-pox concurrently with vaccinia. They are marked with an asterisk.

1. The case of Percy S—— described on p. 35.

2. Sarah T——, (Case No. 421) was born Nov. 18th, 1892.

On Nov. 30th the mother developed the rash of discrete small-pox, and was removed with her unvaccinated baby to the Small-pox Hospital on Dec. 1st.

On Dec. 1st the baby was vaccinated by the Assistant Medical Officer of Health in five places, all of which were successful, giving ultimately 1¼ inch foveate area.

On or about Dec. 13th (*i.e.*, 12 days after the successful vaccination) five small "pimples" were observed, as I am informed, on the child's face. The Assistant Medical Officer of Health regarded these as due to abortive small-pox. The evidence, however, is not very conclusive.

The question as to whether these infants incurred small-pox rests entirely on the nature of the rash.

One of these children developed the pimples on the 9th and the other on the 12th day after successful primary vaccination. I did not see the eruption myself in either case, but looking to the liability of babies to develop eruptions of various kinds, especially after vaccination, when they are known as "vaccination rashes," and to the great severity with which small-pox occurs in children at this time of life, I am inclined to the view that they did not suffer from small-pox; and they are not included in the total 667 cases.

The only other tenable view is that they suffered from small-pox very considerably modified by a concurrent attack of vaccinia.

The facts so far as my information goes are here recorded.

Sub-section b.—On the Influence of Variola on Vaccinia.

Table XXVII.

Cases of Small-Pox occurring in Persons who had been Successfully or Unsuccessfully Vaccinated or Re-vaccinated on Day of Development of the Eruption or at a later Stage of the Disease.

No. of Case.	Book and Page.	Name.	Age.	Date of Primary Vaccination.	Character of Primary Vaccination.	Date of Small-pox Eruption.	Date of Re-vaccination.	Interval between Small-Pox Eruption and Vaccination.	Result of Re-vaccination.	Type of Small-pox.	Result.
69*a*	I. 2	B——, Alice	14	Infancy	3 fov. I.	Nov. 21	Nov. 21	Same day	No effect	Mild	R.
442	XV. 25	H——, William	4 months.	Unvaccinated.		Dec. 3	Dec. 3	Same day	2 good vesicles	Confluent	R.
502	XII. 24	H——, Anne	46	Infancy	1 fov. III.	Jan. 11	Jan. 12	1 day after	2 good vesicles. 2 cic. I.	Very slight	R
571	XIX. 18	M——, Elizabeth	16	Ditto	2 fov. III.	Mar. 13	Mar. 14	1 day after	Unsuccessful	Very mild	R

With the View of throwing Light on the Question whether a previous attack of Small-pox exercises any Influence on Vaccinia, Tables XXVIII. and XXIX. are submitted.

Table XXVIII.

Persons Successfully or Unsuccessfully Vaccinated or Re-vaccinated during and after Convalescence from Small-Pox, contracted either during or previously to the Warrington Epidemic, 1892–3.

No. of Case.	Book and Page.	Name.	Age.	Date of Primary Vaccination.	Character of Primary Vaccination.	Date of Small-Pox eruption.	Type of Small-Pox.	Date of Revaccination.	Result of Re-vaccination.	Interval between Small-Pox eruption and Revaccination.
283	II. 30	M——, George	42	Infancy	2 fov. I.	Nov. 7, 1892	Very mild.	20th November 1892.	Unsuccessful.	13 days.
318	III. 2	C——, Edward	49	„	1 fov. II.	Nov. 9, 1892	Very mild	November 25th 1892.	Did not take.	15 days.
39	IV. 16	B——, Arthur	15	„	2 fov. I.	Sept. 8, 1892	Slight	2 or 3 weeks after recovery.	Unsuccessful.	2 or 3 weeks.
30*a*	VII. 11	M——, Agnes	21	„	3 fov. II.	Aug. 20, 1892	Mild	In September 1892.	„	1 month.
424	IV. 14	H——, Wm. H.	30	„	2 marks	Nov. 10, 1892	„	December 1892	„	About 1 month.
44	V. 4	K——, Alice	24	„	2 fov. cic. I. very good marks.	Sept. 9, 1892	„	1 or 2 months after recovery.	„	1 or 2 months.
8	V. 1	C——, Emanuel	16	„	3 fov. IV.	Aug. 18, 1892	„	November 1892	„	About 3 months.
0	X. 23	H——, Richard	56	„	Good	1836 as baby	Face pitted.	5 times in army	All unsuccessful.	5 times at varying intervals.
0	XII. 25	S——, Francis	42	„	1 fov. IV.	1861, æt. 11	Deeply pitted.	7 times in army	All unsuccessful.	7 times at varying intervals.
0	XII. 7	B——, Sarah	29	„	3 fov. I. (nearly).	1873	Mild	31st October 1892.	Successful (2 fov. IV.)	19 years.
0	XV. 21	G——, Sarah	47	„	1 fov. II.	1862, æt. 17	Much pitted.	15th November 1892.	2 successful.	30 years.
0	XIV. 11	A——, James	59	„	3 f. fov. IV.	1848, æt. 15	Some pitting.	4th December 1892.	2 successful	44 years.

TABLE XXIX.

The EFFECT of VACCINATION on Children born of Mothers who suffered from SMALL-POX during Gestation.

Book Reference.	Name of Patient.	Age.	Date of Rash.	Date of leaving Hospital.	Type of Mother's Case.	Period of Gestation at Advent of Small-pox.	Date of Confinement.	Effects of Vaccination in Child.
256 V. 3	B——, Sarah	28	Nov. 1	Nov. 22	Mild	6 months	Feb. 10, 1893.	Twins vaccinated three times when about 3 months old by Public Vaccinator unsuccessfully.
61 VII. 9	W——, Annie	27	Sept. 13	Oct. 28	Severe discrete	7 months	Oct. 20, 1892.	Vaccinated Oct. 21, 1892, by Dr. Fox in two places, Nov. 7, 1892, resulting in one tiny flat mark measuring ·031 square inch.
XV. 13	N——, Ann	21	Nov. 26	—	Confluent	5 months	Mar. 31, 1893.	Vaccinated at four different times, twice by myself; never successful.

NOTE.—A case of the same class is mentioned on p. 35 (*ante*), P. S.——

As regards the lymph used in the instances mentioned in Tables XXVII., XXVIII., and XXIX., it was a little difficult to get precise particulars as they were nearly all done during the panic and no records kept. But there seemed no reason for suspecting the freshness of the lymph or the efficiency of the operation in any case. It was the practice of the Medical Officer of Health, who is also Public Vaccinator, on going to see a notified case of small-pox to vaccinate the other inmates of the house at once or very soon afterwards, and he informed me that it was his practice then to use Renner's calf lymph stored in tubes. At the Public Vaccination Station, he vaccinated from arm to arm.

As regards Table XXVII. :—

Case 69*a* was done by a private doctor, so also was 442.

Cases 502 and 571 were done in hospital by the Assistant Medical Officer of Health, who uses the same kind of lymph as the Public Vaccinator.

As regards Table XXVIII, the first three were done by private practitioners. Two were done in the army, and the remainder were done at the Public Vaccination Stations, where, at that time, fresh tube-stored calf lymph was used.

As regards Table XXIX., all were done with fresh Renner's lymph stored in tubes, and great care was taken to secure the efficiency of the operation. One of the cases was vaccinated twice unsuccessfully by myself with fresh Renner's calf lymph stored in tubes.

A study of these cases *suggests* :—

1. That if a pregnant woman contracted small-pox during gestation, the child after birth is unsusceptible to vaccination, or, if susceptible, is only very slightly so. Possibly the child contracts small-pox in utero, but none of these children were born pitted.

2. None of these children contracted small-pox after birth, though one was born in hospital. It would therefore seem that a similar immunity to this disease is also produced by small-pox in the mother during gestation.

Sub-section c.—Influence of Variola on Variola.

There were five out of the 667 cases in which satisfactory evidence was obtained that they had previously suffered from an attack of small-pox. They are presented in detail in Table XXX. Much care is required in accepting statements on this subject of previous small-pox. The value of the different kinds of evidence has been discussed on p. 23, *ante*.

The only remarks which this table calls for are—

1. That the shortest interval between the two attacks in any individual was 19 years; and
2. That the attack-rate amongst those exposed, in the infected houses, was higher amongst those who had previously had small-pox than amongst those who had been re-vaccinated (*vide* Table X., *ante*).

TABLE XXX.

GIVING PARTICULARS of FIVE PERSONS previously attacked by SMALL-POX who also incurred an ATTACK in 1892–93.

Case.	Reference No.	Name.	Age at First Attack of Small-pox.	If marked by First Attack.	Age at Second Attack of Small-pox.	Type of Small-pox Second Attack.	Particulars as to Primary Vaccination.	Re-vaccination.
216	XII. 16	B——,	Infancy	Marks on shoulder	32 years	Very mild	Infancy, 3 fov. $\frac{1\ \text{I.}}{2\ \text{II.}}$	Never.
310	XII. 27	H——, Thos.	2 weeks old	Marked	39 „	Discrete	Unvaccinated	„
331	III. 10	G——, John	12 months	Pits on face and arms.	27 „	Mild	Infancy, 2 fov. I.	„
453	II 32	T——, Caroline	10 years	Pits on face and arms.	29 „	„	10 years old. 2 faint fov. III.	„
620	XVIII. 19	*M——, Mary	Before 10 years	If marked, marks covered by second attack.	30 „	Confluent	Infancy, 1 fov. II.	æt. 10 (1873), successfully vaccinated (1 fov. I.)

* Full particulars of this case are given on p, 43, *ante*,

Table XXXI.

Showing the Vaccinated Condition of 2,535 Persons exposed to Infection in 437 infected houses at the different age periods; the ATTACK-RATE in each, and the FATALITY of the disease. 618 cases arose in these houses (*vide* footnote).

—	Age period, 0–10. 688 persons, 58 cases.						Age period, 10–20. 681 persons, 162 cases.						Age period, 20–30. 475 persons, 222 cases.					
	Well Vaccinated.	Indifferently Vaccinated.	Doubtfully Vaccinated.	Unvaccinated.	Revaccinated.	Previous Small-pox.	Well Vaccinated.	Indifferently Vaccinated.	Doubtfully Vaccinated.	Unvaccinated.	Revaccinated.	Previous Small-pox.	Well Vaccinated.	Indifferently Vaccinated.	Doubtfully Vaccinated.	Unvaccinated.	Revaccinated.	Previous Small-pox.
Of 2,535 people in infected houses there were -	484	133	16	55	0	0	460	168	16	19	17	1	279	140	20	14	19	3
Of whom 618 contracted small-pox - - -	18	9	1	30	0	0	114	32	3	13	0	0	135	66	7	9	3	2
Case incidence per cent. -	3·72	6·77	6·25	54·54	0	0	24·78	19·05	18·75	68·42	0	0	48·39	47·14	35·00	64·29	15·77	66·6
58 deaths - - -	0	2	0	11	0	0	1	0	0	2	0	0	2	5	3	3	0	0
Case mortality per cent. -	0	22·2	0	36·6	0	0	0·8	0	0	15·4	0	0	1·5	7·6	42·8	33·3	0	0

—	Age period, 30–40. 286 persons, 111 cases.						Age period, 40–50. 229 persons, 42 cases.					
	Well Vaccinated.	Indifferently Vaccinated.	Doubtfully Vaccinated.	Unvaccinated.	Revaccinated.	Previous Small-pox.	Well Vaccinated.	Indifferently Vaccinated.	Doubtfully Vaccinated.	Unvaccinated.	Revaccinated.	Previous Small-pox.
Of 2,535 people in infected houses there were -	131	102	20	7	12	14	117	76	15	5	8	8
Of whom 618 contracted small-pox - - -	36	56	7	6	3	3	19	15	5	2	1	0
Case incidence per cent. -	27·48	54·90	35·00	85·71	25·00	21·42	16·24	19·74	33·33	40·0	12·5	0
58 deaths - - -	3	7	4	4	0	0	3	2	3	1	0	0
Case mortality per cent. -	8·3	12·5	57·1	66·6	0	0	15·8	13·3	60·0	50·0	0	0

—	Age period, 50–60. 127 persons, 16 cases.						Age period, 60 and upwards. 49 persons, 7 cases.					
	Well Vaccinated.	Indifferently Vaccinated.	Doubtfully Vaccinated.	Unvaccinated.	Revaccinated.	Previous Small-pox.	Well Vaccinated.	Indifferently Vaccinated.	Doubtfully Vaccinated.	Unvaccinated.	Revaccinated.	Previous Small-pox.
Of 2,535 people in infected houses there were -	38	61	9	6	4	9	14	21	4	1	3	6
Of whom 618 contracted small-pox - - -	7	8	1	0	0	0	0	6	1	0	0	0
Case incidence per cent. -	18·42	13·11	11·11	0	0	0	0	28·57	25·00	0	0	0
58 deaths - - -	1	0	0	0	0	0	0	1	0	0	0	0
Case mortality per cent. -	14·3	0	0	0	0	0	0	16·6	0	0	0	0

Note.—The Workhouse, Fever Hospital, Common Lodging-Houses, and 14 other houses whose inmates could not be traced, are excluded from this table, as it was not possible to obtain the facts as to vaccination of the other inmates in these with the same degree of accuracy as in the remaining 437 houses: 20 houses containing 49 cases are therefore excluded.

SECTION VIII.—THE DURATION OF PROTECTION FROM, AND MODIFICATION OF SMALL-POX, AFFORDED BY PRIMARY VACCINATION.

This subject may be approached by an inquiry into the attack-rate at different age-periods among the vaccinated and unvaccinated persons exposed (*i.e.*, duration of power to protect); the severity of small-pox and case-mortality at different age-periods among the vaccinated and unvaccinated cases (*i.e.*, duration of power to modify); and, lastly, by a detailed examination of the vaccinated and unvaccinated cases of small-pox under 10 years of age, and at each succeeding decade of life. Table XXXI., page *ante*, gives a minute analysis of the data available. But it will be advisable, as before, to consider the alleged *protecting* power and the alleged *modifying* power separately.

Sub-section a.—Duration of power to protect against attack.

The following tables (XXXII. and XXXIII.) showing the attack-rate at different age-periods among the vaccinated and unvaccinated persons examined in the infected houses, are now submitted.

The heaviest attack-rate (47 per cent.) among the vaccinated persons is in the third decade of life (20–30), which is more than twice that of the decade below. Next comes the fourth decade (30–40) with 39 per cent., then in order—the second decade (23 per cent.), fifth, seventh, sixth, and lastly the first decade with an attack-rate of only 4 per cent.

The gradual decline in the attack-rate in the fourth, fifth, seventh, and sixth decades may probably be accounted for by the increasing immunity from attack by nearly all infectious diseases which seems to be conferred on advancing years.

The comparative immunity (4 per cent.) from attack amongst persons exposed in the 0–10 decade of life may be accounted for by vaccination (Section II., page 26).

The heavy incidence in the 20–30 decade seems to show that the protective power of primary vaccination to a considerable extent wears off after 20.

TABLE XXXII.

SHOWING the ATTACK-RATE at different AGE-PERIODS amongst 2,324 VACCINATED Persons in the 437 Infected Houses, in which 546 cases arose.

—	Age-periods.						
	(1.) 0–10.	(2.) 10–20.	(3.) 20–30.	(4.) 30–40.	(5.) 40–50.	(6.) 50–60.	(7.) 60 and upwards.
1,523 well vaccinated persons - -	484	460	279	131	117	38	14
701 indifferently vaccinated persons -	133	168	140	102	76	61	21
100 doubtfully vaccinated persons -	16	16	20	20	15	9	4
2,324 total of three vaccinated classes in infected houses - - - -	633	644	439	253	208	108	39
Among whom 546 cases occurred - -	28	149	208	99	39	16	7
Per-centage of people at that age attacked = attack-rate - - -	*4·4*	*23·1*	*47·4*	*39·1*	*18·7*	*14·8*	*17·9*

NOTE.—The revaccinated, and those protected by a previous attack of small-pox are excluded from this table.

TABLE XXXIII.

GIVING the ATTACK-RATE at different age-periods among the 107 UNVACCINATED persons exposed in the 437 infected houses, for comparison with Table XXXII.

—	Age-periods.						
	(1.) 0–10.	(2.) 10–20.	(3.) 20–30.	(4.) 30–40.	(5) 40–50.	(6.) 50–60.	(7.) 60 and upwards.
107 unvaccinated persons exposed in these houses.	55	19	14	7	5	6	1
60 unvaccinated persons attacked in these houses.	30	13	9	6	2	0	0
Per-centage of persons attacked (attack-rate)	*54·5*	*68·4*	*64·3*	*85·7*	*40·0*	*0*	*0*

Sub-section (b.) The duration of modifying power over Small-Pox afforded by Primary Vaccination.

Table XXXIV. presents an analysis of 586 persons who, having been vaccinated in infancy and not since, contracted small-pox during the Warrington epidemic, 1892–93, and shows the relative severity and case-mortality at the different age-periods of life.

1. A study of these figures shows that the *case-mortality* among the vaccinated cases is *6·5* per cent., that among the unvaccinated cases being *35·3* per cent. One death in each of the first two decades of life should not really be included as due to small-pox. From these figures it would seem that no one under 20 who has been vaccinated in infancy need have very much fear of dying from small-pox *per se*. At any rate, it would seem that the power of vaccination over the fatality of small-pox is good (though it diminishes gradually) up to 40. Though even in the fifth decade the modifying power is not entirely lost, if comparison be made with the unvaccinated figures given below, and those of other observers (p. 55).

2. The *severity of the disease* in the vaccinated (primary vaccination only) as measured by the proportion of confluent cases, steadily rises, and more uniformly, up to the same decade (40–50), which again is the highest, and then falls.

This fact tallies with and confirms the preceding one.

Thus, on both grounds (case-mortality and case-severity) the power of vaccination to modify small-pox would seem to last longer by some 20 years than its power to protect from infection; for the power to *modify* is least in the 5th decade, and the power to *protect* (Table XXXII.) is least in the 3rd decade.

Table XXXV. gives a similar analysis of the unvaccinated cases in Warrington in 1892–93 for comparison with Table XXXIV.

The figures in Tables XXXIV. and XXXV. have the merit of being based on persons living side by side in the infected houses, under precisely the same environments in all respects.

Important data as to the age when re-vaccination should be performed may be deduced from the foregoing observations, in Sub-sections *a* and *b*.

HISTORICAL

We have not an exact record of the number, age, and type of all the cases which arose during the epidemic of 1773 so that the attack-rate, case-severity, and case-mortality, at different age-periods of that outbreak cannot be numerically expressed; but thanks to Dr. Percival we have (p. 37, *ante*) a very exact table recording the ages of the fatal cases.

It is unnecessary to repeat here the comments on this table, but, if we bear in mind that, owing to the endemic prevalence of small-pox in those times, almost every inhabitant who survived the early years of existence grew up protected by an attack of the disease, it will be seen that the facts there set forth tally with those just now mentioned, and the conclusion is irresistible that it was vaccination which afforded protection against, and modification of, small-pox in the earlier decades of life in the epidemic of 1892–3.

Sub-section (c.) Cases of Small-pox in Children under 10.

Next let us consider in detail the cases of small-pox which occurred in the first decade of life. Tables XXXVI. and XXXVII. give full particulars of these cases, vaccinated and unvaccinated respectively (pp. 52 and 53).

TABLE XXXIV.

SHOWING the CASE-TYPE and CASE-MORTALITY at different Age-periods among the 586 Persons PRIMARILY VACCINATED who contracted SMALL-POX. (Total number.)

—	Age-periods.						
	(1.) 0–10.	(2.) 10–20.	(3.) 20–30.	(4.) 30–40.	(5.) 40–50.	(6.) 50–60.	(7.) 60 and upwards.
321 mild cases - - - - -	24	108	121	46	13	6	3
137 discrete cases - - - - -	7	38	46	25	10	7	4
128 confluent cases, including malignant or hæmorrhagic.	2	10	55	39	17	4	1
586 total cases - - - - -	33	156	222	110	40	17	8
38 deaths - - - - -	2*	1†	10	14	9	1	1
Case-mortality (per-centage) - -	*6·0*	*0·6*	*4·5*	*12·7*	*22·5*	*5·9*	*12·5*
Case-severity, as shown by per-centage of confluent cases.	*6·0*	*6·4*	*24·8*	*35·5*	*42·5*	*23·5*	*12·5*

NOTE.—The re-vaccinated, and those persons who had previously incurred an attack of small-pox, are excluded from this table.

* One of these cases, 607, æt. nine years and two months, was at the time ill with inflammation of the lungs and bowels, and the small-pox was only a contributory cause of death (p. 34).

† This young man (case 117) had recovered from the small-pox, and then incurred pyæmia, from which he is certified as dying (p. 34).

TABLE XXXV.

SHOWING the CASE-TYPE and CASE-MORTALITY at different age-periods among the 68 UNVACCINATED cases of SMALL-POX in the Warrington epidemic, 1892–3. (Total number—eight arose in the excluded houses, *vide* p. 22.)

—	Age-periods.						
	(1.) 0–10.	(2.) 10–20.	(3.) 20–30.	(4.) 30–40.	(5.) 40–50.	(6.) 50–60.	(7.) 60 and upwards.
3 mild cases - - - - -	2	0	1	0	0	0	0
17 discrete cases - - - - -	7	8	0	1	1	0	0
48 confluent, malignant, and hæmorrhagic cases.	23	10	9	5	1	0	0
68 total cases - - - - -	32	18	10	6	2	0	0
24 fatal cases - - - - -	12	3	4	4	1	0	0
Case mortality (per-centage) - -	*37·5*	*16·6*	*40·0*	*66·6*	*50·0*	*0*	*0*
Case severity (per-centage of confluent cases).	*71·9*	*55·5*	*90·0*	*83·3*	*50·0*	*0*	*0*

Table XXXVI.

Giving Particulars of 33 Cases of Small-pox occurring in Vaccinated Children under 10 Years of Age, who had been Primarily Vaccinated.

No.	Name.	Sex.	Age.	Date of				Attack.		Primary Vaccination.				Remarks.
				Onset.	Rash.	Removal to Hospital.	Termination.	Type.	Result.	Date.	Marks.			
											No.	Character.	Area.	
$\frac{\text{IV.}}{1}$ 3	L——, Hettie	F.	9	—	Aug. 18	Already in H.	Sep. 13	Slight -	Recov.	Infancy	1	Fov. cic. -	III.	
$\frac{\text{V.}}{4}$ 5	A——, Josiah	M.	4	—	Aug. 19	Never	5 weeks	Mild -	„	„	1	„ -	II.	
$\frac{\text{VI.}}{15}$ 26	S——, Walter	M.	9	—	Aug. 30	Sep. 21	—	„ -	„	„	3	Fov. -	IV.	
$\frac{\text{VI.}}{4}$ 25	B——, Thomas	M.	9	Sep. 2	Sep. 4	Sep. 19	—	„ -	„	„	1	Fov. cic. -	IV.	
$\frac{\text{II.}}{3}$ 75	L——, James	M.	8	Sep. 18	Sep. 20	Sep. 22	Sep. 29	Confluent	Died	—	—	—	—	
$\frac{\text{IV.}}{23}$ 55*a*	J——, Ada -	F.	9	—	Dec. 12	In Hosp.	—	Slight -	Recov.	Infancy	1	Fov. -	III.	Was convalescing from scarlet fever at the time.
$\frac{\text{VI.}}{19}$ 77	P——, Henry	M.	7	Sep. 20	Sep. 22	Sep. 23	Oct. 26	Mild -	„	„	3	Faint fov.	II.	
$\frac{\text{VII.}}{18}$ 81	W——, Josiah	M.	9	Sep. 19	Sep. 22	Sep. 23	Nov. 15	Discrete -	„	„	—	Marks -	—	
$\frac{\text{II.}}{10}$ 85	P——, Annie	F.	8	Sep. 18	Sep. 23	Sep. 24	—	„ -	„	„	2	Fov. -	II.	
$\frac{\text{V.}}{12}$ 113	C——, Arthur	M.	5	Sep. 24	Sep. 26	Sep. 30	Oct. 15	Mild -	„	„	2	„ -	I.	
$\frac{\text{XIV.}}{28}$ 106	M——, Emily	F.	4	—	Sep. 28	Sep. 30	—	Very mild	„	„	2	„ -	$\frac{\text{IV.}}{\text{III.}}$	
$\frac{\text{V.}}{23}$ 124	H——, Edith	F.	9	Sep. 21	Sep. 28	Oct. 2	Nov. 21	Discrete -	„	„	2 1	„ - „ -	IV. II.	
$\frac{\text{V.}}{13}$ 129	W——, William.	M.	9	Oct. 1.	Oct. 2	Oct. 2	Oct. 9	Very mild	„	„	4	Marks -	—	
$\frac{\text{V.}}{24}$ 125	H——, Lilly -	F.	7	Oct. 1	Oct. 11	Oct. 2	Nov. 13	„ -	„	„	3	Faint fov.	II.	
$\frac{\text{XVI.}}{1}$ 173	P——, Nellie	F.	6	—	Oct. 14	Never	10 days.	Mild -	„	„	2	Fov. -	$\frac{\text{II.}}{\text{IV.}}$	
$\frac{\text{IX.}}{1}$ 215	H——, Richard.	M.	7	Oct. 19	Oct. 23	Oct. 24	2 wks.	Very mild	„	„	3	Good marks	—	
$\frac{\text{XV.}}{37}$ 220	R——, Lilly -	F.	6	—	Oct. 23	Oct. 25	8 days	Mild -	„	„	3	„ -	—	
$\frac{\text{VII.}}{15}$ 281	W——, Alice	F.	7	Nov. 2	Nov. 3	Nov. 8	Dec. 5	Discrete -	„	„	3	Marks -	—	
$\frac{\text{IV.}}{2}$ 302*a*	M——, Annie	F.	7	—	Nov. 9	In Hosp	Dec. 5	„ -	„	„	2	Plane -	IV.	
$\frac{\text{X.}}{25}$ 337	H——, John-	M.	8	Nov. 11	Nov. 11	Never	—	Very mild	„	„	3	Good marks	—	
$\frac{\text{II.}}{16}$ 376*a*	L——, Joseph	M.	8	—	—	—	—	Mild -	„	„	2	Good marks	—	
$\frac{\text{II.}}{16}$ 377*a*	L——, John -	M.	4	—	—	—	—	„ -	„	„	1	Fov. -	II.	
$\frac{\text{XIII.}}{14}$ 415	M——, Catherine.	F.	8	Nov. 25	Nov. 28	Nov. 29	—	„ -	„	„	3	Faint fov.	IV.	
$\frac{\text{XIII.}}{14}$ 416	M——, John	M.	6	Nov. 25	Nov. 28	Nov. 29	—	Very mild	„	„	3	Deep, 2; cic., 1; scars.	$\frac{\text{II.}}{\text{IV.}}$	
$\frac{\text{VIII.}}{13}$ 475	H——, Samuel	M.	9	Dec. 16	Dec. 18	Dec. 19	—	„ -	„	„	3	Fov. -	II.	
$\frac{\text{XII.}}{17}$ 507	B——, John -	M.	9	—	Jan. 15	Jan. 16	—	Mild -	„	„	3	„ -	III.	
$\frac{\text{XIV.}}{29}$ 538	P——, Sarah	F.	9	Feb. 4	Feb. 5	Feb. 6	—	„ -	„	„	3	Good marks	—	
$\frac{\text{XVIII.}}{17}$ 564	B——, David	M.	7	—	Mar. 10	Mar. 10	—	„ -	„	„	3	Fov. -	III.	
$\frac{\text{XIX.}}{24}$ 568	H——, Marion	F.	5	—	Mar. 11	Mar. 11	—	Very mild	„	„	4	Fov. -	III.	
$\frac{\text{XIX.}}{29}$ 580	R——, Eliz. -	F.	9	—	Mar. 22	Mar. 24	—	Mild -	„	„	2	„ -	I.	
$\frac{\text{XVIII.}}{19}$ 607	M—— John	M.	9	Apr. 1	Apr. 4	Apr. 6	Apr. 21	Confluent	Died -	„	2	Small mrks.	—	When he caught small-pox, was ill with inflammation of bowels and lungs, of which he died.
$\frac{\text{XIX.}}{15}$ 617	M——, Jano	F.	8	—	Apr. 14	Apr. 16	—	Discrete -	Recov.	„	3	Fov. cic. -	III.	
$\frac{\text{XVIII.}}{20}$ 631	C——, Kate -	F.	7	Apr. 20	Apr. 22	Apr. 24	—	„ -	„	„	3	Good marks	—	

TABLE XXXVII.

GIVING PARTICULARS of 32 Cases of SMALL-POX occurring in UNVACCINATED CHILDREN under 10 Years of Age.

Book Reference.	No.	Name.	Sex.	Age.	Date of				Attack.		Primary Vaccination.	Remarks.
					On-set.	Rash.	Removal to Hospital.	Termination.	Type.	Result.		
VI. 9	35	W——, Maria	F.	8	Sep. 5	Sep. 7	Sep. 19	Nov. 2	Severe discrete.	Recvd.	Unvaccinated	Vaccinated 2 days before rash, 1 faint IV.
II. 4	80	L——, Walter	M.	5	Sep. 18	Sep. 21	Sep. 22	—	„	Recvd.	„	Vaccinated 1 day before rash.
XII. 6	152	B——, Joseph	M.	7	Oct. 4	Oct. 6	Oct. 9	—	„	„	„	
XIV. 26	147	H——, Joseph	M.	5	Oct. 4	Oct. 7	Oct. 8	—	Discrete	„	„	
II. 17	182	M——, Alice	F.	10 days	Oct. 11	Oct. 14	Oct. 17	Oct. 21	Confluent	Died	„	Vaccinated 3 days before rash.
XI. 2	200	H——, Frank	M.	4	Oct. 16	Oct. 19	Oct. 19	—	Semi-confluent.	Recvd.	„	Vaccinated 10 days before rash.
XIII. 7	260	M——, Sarah	F.	8	—	Oct. 20	Never	Nov. 3	Confluent	Died	„	
X. 2	218	K——, Michael	M.	5	Oct. 20	Oct. 22	Oct. 23	—	„	Recvd.	„	
X. 8	217	H——, George	M.	8	Oct. 20	Oct. 23	Oct. 24	—	„	„	„	
XIV. 22	280	T——, John	M.	8	Nov. 4	Nov. 6	Nov. 7	—	„	„	„	
I. 5	348	H——, Anne	F.	10 days	—	Nov. 10	Never	Nov. 14	Discrete	Died	„	
XIV. 27	372	B——, William	M.	15 days	—	Nov. 15	Nov. 17	Nov. 22	Confluent	„	„	Vaccinated 7 days before rash.
II. 25	371	K——, Thomas	M.	9	Nov. 13	Nov. 16	Nov. 20		„	Recvd.	„	
IV. 14	426	H——, Gladys	F.	1 month	—	Nov. 17	Never	Dec. 6	„	Died	„	
XV. 1	391	M——, Mary	F.	4	—	Nov. 18	In hospital.	Nov. 30	„	„	„	
XV. 8	390	M——, William	M.	3	Nov. 18	Nov. 20	Nov. 24	Nov. 28	„	„	„	
V. 21	417	T——, Joseph	M.	6	Nov. 26	Nov. 28	Never	Dec. 28	Discrete	Recvd.		
XIV. 19	422	H——, Thomas	M.	5	Nov. 26	Nov. 28	Dec. 2	—	Discrete, abcesses during convalescence.	„	„	
XI. 17	428	C——, John	M.	5	Nov. 25	Nov. 28	Dec. 2	—	Discrete	„	„	
XV. 25	442	H——, John	M.	15 weeks	—	Dec. 3	Dec. 26	—	Confluent	„	„	Vaccinated same day as rash, 2 good vesicles.
XV. 11	459	M——, Austin	M.	9	Dec. 4	Dec. 7	Dec. 13	—	„	„	„	
XI. 13	461*a*	E——, Mary	F.	13 days	—	Dec. 16	Dec. 12	Dec. 21	„	Died	„	Vaccinated same day as removal 3 successful.
XV. 14	471	C——, John	M.	13 days	—	Dec. 14	Dec. 16	Dec. 16	„	„	„	
V. 7	474	T——, Henry	M.	17 months	—	Dec. 19	Dec. 19	Dec. 21	„		„	Vaccinated four days before rash
V. 4	487	M——, Stanley	M.	4	—	Jan. 1	Jan. 1	—	Semi-confluent.	Recvd.	„	
XIV. 7	517	B——, Sarah	F.	9	—	Jan. 21	Jan. 22	—	Confluent	„	„	Vaccinated on the day after rash.
XVI. 21	553	C——, Mary	F.	2 years 8 months	—	Feb. 23	Feb. 23	—	Discrete	Recvd.	„	
XVIII. 23	642	D——, William	M.	11 weeks	Apr. 25	Apr. 26	Apr. 30	—	Confluent	„	„	
XIX. 2	651	O'B——, John	M.	2	May 6	May 10	May 12	—	Mild	„	„	
XIII. 33	157	G——, Rob.	M.	1 month	Oct. 8	Oct. 8	Oct. 10	Oct. 12	Confluent	Died	„	
VI. 13	19	M——, James	M.	20 days	Aug. 29	Aug. 30	—	Sep. 6	„	„	„	
XX. 11	556	G——, Annie	F.	8	Feb. 23	Feb. 24	Feb. 26	—	Very mild	„	—	

Remarks on Tables XXXVI. and XXXVII.

There were, in all, 65 cases in persons under 10 years of age [*i.e., 10 per cent.* of all the cases (667)].

The following Table XXXVIII. shows a comparison of the vaccinated and unvaccinated cases at this age. 33 of these were vaccinated and 32 were unvaccinated.

The facts referring to protection from, and modification of small-pox revealed in the previous sections of this report receive confirmation from these particulars.

But, in order to arrive at some idea of the duration of such protection and modification in the earlier period of life, I have made the following analysis of the ages of the cases in the first decade of life (Table XXXIX.). It shows also the number of persons exposed at that age, and the type of the case. (*Remarks and Conclusions continued on p.* 55.)

TABLE XXXVIII.

GIVING a COMPARISON between SMALL-POX as it occurred in the 33 VACCINATED CASES and the 32 UNVACCINATED CASES under 10 years of age in the Warrington Epidemic, 1892–93, these being all that were known to occur in the respective Groups.

—	Attack Rate.	Case Severity.			Deaths.	Per-centage Fatality.
		Actual Number of Cases of—				
	Per-centage of Persons attacked among Persons exposed in the Infected Houses at that Age.	Mild.	Discrete.	Confluent, Hæmorrhagic, Malignant.		
33 vaccinated cases under 10 - -	*5·1*	24	7	2	2	*6·0*
32 unvaccinated cases under 10 -	*56·1*	2	7	23	12	*37·5*

TABLE XXXIX.

GIVING the AGE-PERIODS of the 33 VACCINATED and the 32 UNVACCINATED CASES of SMALL-POX under 10 years of age (being all that occurred in the Warrington 1892–93); showing also their type, fatality, and number of persons exposed to infection **in the Infected Houses.**

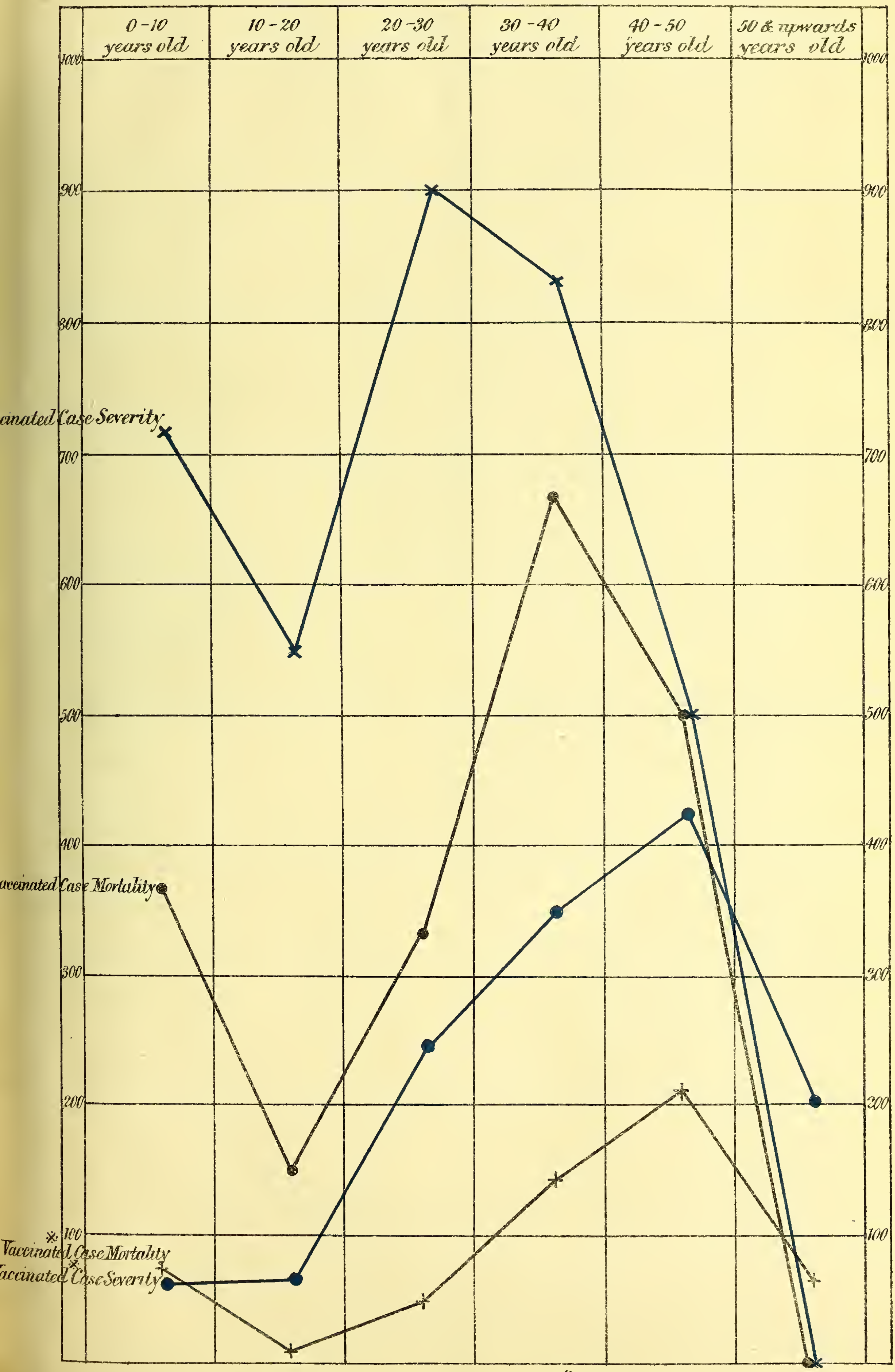
—	**Vaccinated**, and **doubtfully Vaccinated** Persons.					**Unvaccinated** Persons.				
	Total No. of Persons exposed.	Type of Cases.	Total attacked.	Attack-rate per cent.	Case-mortality per cent.	Total No. of Persons exposed.	Type of Cases.	Total attacked.	Attack-rate per cent.	Case-mortality per cent.
1 month and under -	5	- - - -	0	*0*	*0*	13	**C. D. C. C. C. C. C. C.**	8	*61·5*	*100·0*
1 to 3 months -	8	- - - -	0	*0*	*0*	6	C. - - - -	1	*16·6*	*0*
3 „ 12 „ -	52	- - - -	0	*0*	*0*	3	C. - - - -	1	*33·3*	*0*
1 „ 2 years - -	60	- - - -	0	*0*	*0*	2	**C.** - - -	1	*50·0*	*100·0*
2 „ 3 „ - -	72	- - - -	0	*0*	*0*	2	M. D. - - -	2	*100·0*	*0*
3 „ 4 „ - -	75	- - - -	0	*0*	*0*	2	**C.** - - - -	1	*50·0*	*100·0*
4 „ 5 „ -	60	M. M. M. - -	3	*5*	*0*	4	C. **C.** C. - -	3	*75·0*	*33·3*
5 „ 6 „ - -	47	M. M. - - -	2	*4·2*	*0*	8	C. D. C. D. D. -	5	*62·5*	*0*
6 „ „ - -	63	M. M. M. - -	3	*4·9*	*0*	3	D. - - - -	1	*33·3*	*0*
7 „ 8 „ - -	67	M. M. M. D. D. M. D.	7	*10·4*	*0*	1	C. - - - -	1	*100·0*	*0*
8 „ 9 „ -	55	D. M. M. M. D. **C.**	6	*10·9*	*16·6*	6	D. **C.** C. C. M. -	5	*83·3*	*20·0*
9 „ 10 „ - -	69	M. M. M. M. D. D. M. M. M. M. M. **C.***	12	*17·4*	*8·3*	5	C. C, C. - - -	3	*60·0*	
	633		33			57		32		

Explanatory note:—M = mild. D = discrete. C = confluent. The deaths are printed in block type.

* Vide footnote to Table XXXIV., p. 51, *ante.*

CHART *showing the Case Mortality (black) and the Case Severity* (blue) per 1000 persons living of the Unvaccinated and the Vaccinated in the different age periods among that portion of the population of Warrington living in the infected houses in 1892-1893.*

(Extracted from table XXXI.)



※ *Vaccinated once only during their lives, including also those "Doubtfully Vaccinated".*

* *Proportion of Confluent cases to total cases at that age*

To face page 54 (i)

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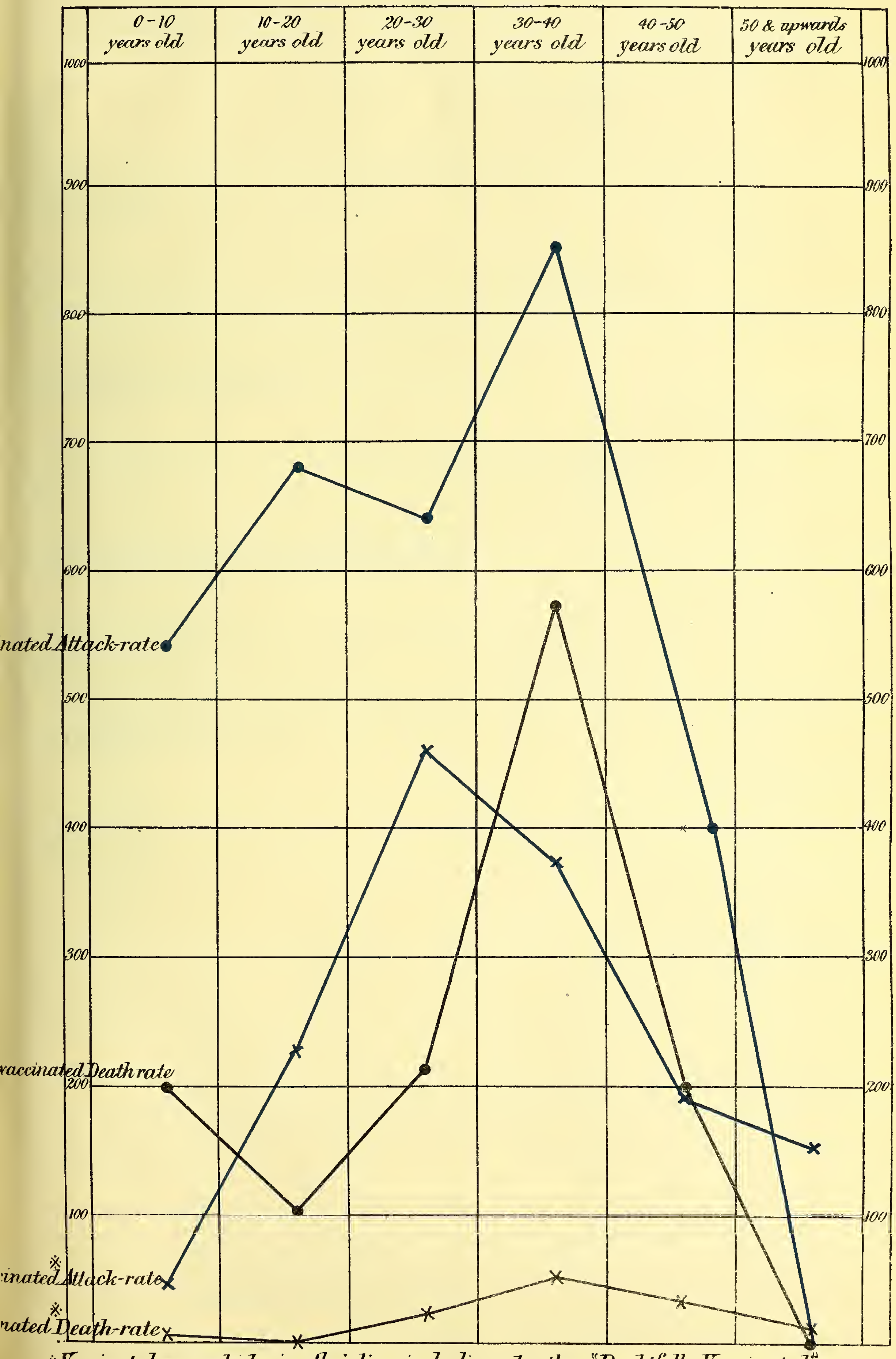
CHART *showing the Attack-rate (blue) and Death-rate (black) per 1000 persons living, of the Unvaccinated and the Vaccinated in the different age periods among that portion of the population of Warrington exposed to infection in the infected houses in 1892-1893.*

(Extracted from table XXXI.)



** Vaccinated once only during their lives, including also those "Doubtfully Vaccinated."*

To face page 54 (ii).

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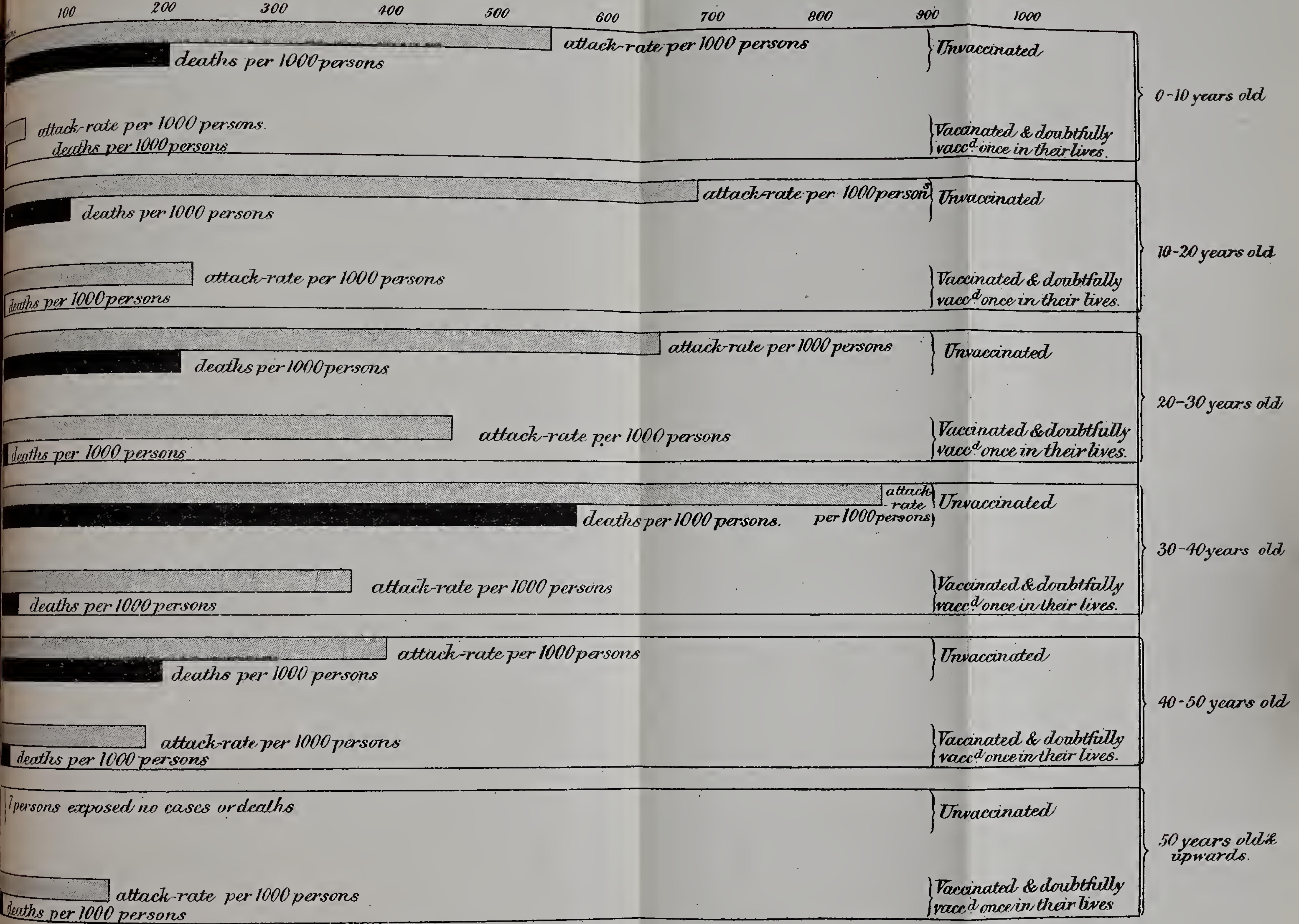
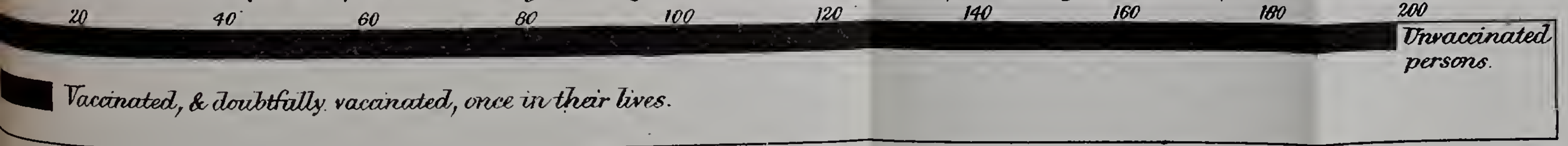
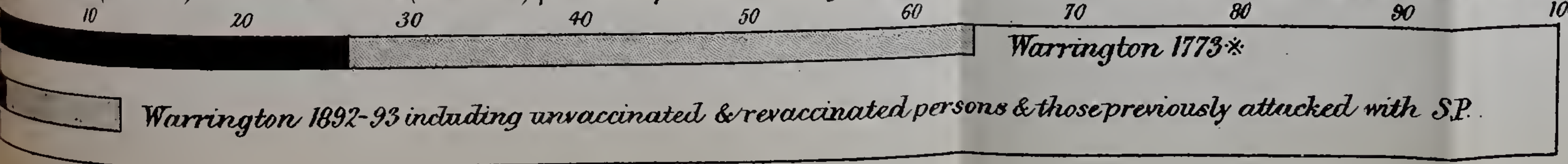
CHART showing the proportion of the Attack-rate and Death-rate per 1000 persons living, in different classes and age periods, among that portion of the population of Warrington living in the Infected houses in 1892-1893.
(derived from Table XXXI.)



Death-rate per 1000 persons of all ages living in the Infected houses, Warrington 1892-93 (vide table X p. 27.)



Death-rate (black.) & Attack-rate (shaded) per 100 persons living in Warrington in 1773 & 1892-93 respectively both in infected & uninfected houses.



e page 54 (iii).

* The attack-rate in 1773 is Mr Aikin's estimate.

The salient points in this sub-section (*c*) are—

(1) That out of 633 vaccinated persons under 10 exposed in the infected houses 33 contracted the small-pox, all but two in a comparatively mild form, and only one died of that malady alone.

(2) That out of 55 unvaccinated persons under 10 exposed in the infected houses, 32 contracted the small-pox in a severe form, and 12 of them died of that malady alone.

Such a comparison might be objected to on the ground that the unvaccinated children died of small-pox more readily because of the ailing health which was also the reason of their non-vaccination. But my inquiries on this head led me to conclude that in the vast majority of instances, the cause of non-vaccination in these 55 unvaccinated children was, as already stated (p. 23), the passive negligence of their parents. The general health of all of these children, vaccinated and unvaccinated, appeared to be good, excepting the solitary instance of John M—— æt. 9 years and 2 months. Living side by side in the same houses, and under the same hygienic and social conditions, these groups seemed to me to be strictly comparable.

One is here reminded of the proportion of cases to deaths in Warrington in 1773, as estimated by Rev. J. Aikin (p. 36, *ante*). This observer tell us that in one neighbourhood out of 29 who had the disease 12 died. Now, as all the 211 cases who died in 1773 were under nine years of age it is very possible that most of the 29 persons attacked were under that age, an assumption rendered more reasonable as we know that persons at the later decades of life were probably protected by a previous attack of the disease in early life, from which they had happily survived. If so, the case-mortality among the unvaccinated in Warrington 1773 (41 per cent.) corresponded within little of the case-mortality among the unvaccinated in Warrington 1893 (37·5 per cent.).

—	Cases.	Deaths.	Fatality Per-centage.
Unvaccinated in Warrington, 1773.	29 (probably) under 9	12	41·0
Unvaccinated in Warrington, 1893.	32 cases under 10	12	37·5

Protection from small-pox would seem to be very complete in the early periods of life, for 272 persons under 4 were exposed to infection in the infected houses, yet none of them contracted the disease. About seven, eight, and nine years this protection seems to be commencing to wear off. But the *modifying* power still remains throughout the first decade of life, for here there were only two vaccinated confluent cases (who died) both after the age of 8, and one was in a child ill of another malady.

Subsequent Decades.

As regards the second and subsequent decades there are not sufficient unvaccinated cases to make a comparison profitable, but it would seem that in an average person the power of primary vaccination to *protect* against small-pox dies away in the third (20 to 30) decade of life (Table XXXII.), and the power of vaccination to *modify* small-pox diminishes in the fifth (40 to 50) decade (Table XXXIV.). Though even in the fifth decade it is not lost. There were 9 deaths out of 40 cases, or a fatality of 22·5 per cent. as compared with a fatality of 72 per cent. among unvaccinated cases at this time of life as given by Marson* from the 2,654 unvaccinated cases admitted into the London Fever Hospital, 1836–51.

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* Reynolds' System of Medicine, Vol. I., p. 239.

SECTION IX.—ON THE EVILS ALLEGED TO ARISE FROM VACCINATION.

Precise particulars of the vaccinated condition of 5,778 persons were inquired into by me or my medical assistants, and in three instances specific allegations were made against the practice of vaccination.

1. The sister of Case 120, a girl of 10, was stated by her mother (living in Glasshouse Row) to have been subject to "blotches" on and off ever since a month or two after vaccination at the age of six months, and to have had "a gathered navel" and "abscesses" since then. The child when I saw her (Jan. 19, 1893) had a typical syphilitic lepra on the body, and a discharge from the nose. The mother informed me that the child had "never "been well from birth." The other children were healthy, but their mother had had four miscarriages after the birth of this child.

2. Mary F———, at 21 (a discrete case of small-pox, No. 567), stated that she had had a breaking-out on the head ever since being vaccinated in infancy. I examined her head and found her to be suffering from dandriff, such as sometimes ensues from a neglected ring-worm of the scalp.

3. The case of Percy S———, who was certified as having died from "premature birth—vaccination" at the age of 17 days, was the subject of a separate Report * and is referred to also on p. 35, *ante*. After making a special inquiry into this case I came to the conclusion that "the "chief, and probably the only cause of death was asthenia "due to its premature birth, and that vaccination took "little or no part in the causation."

These were the only cases which came to light.

Revaccination.

Very few people were revaccinated prior to the epidemic, but during the panic it is estimated that 16,000 or 17,000 persons were done.

The father of case 281 stated he had lost seven weeks' work by his arm being bad after revaccination in November 1892. His doctor informed me that he had suffered from cellulitis.

I was informed that some 66 revaccinated employees at the Dallam and Bewsey Forge out of about 1,400 done, (five per cent.) were away from work on this account for four or more days. However, it is not well to attach too much importance to this because it is within my knowledge that many of them stay away from work, or as they appropriately term it "go on play," for very little.

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* March 15, 1893. *See* the Appendix to Report of the Royal Commission on Vaccination—(Alleged deaths from Vaccination).

SUMMARY.

The statistical facts and circumstances, mentioned in the foregoing pages with so much prolixity in order that they may be fully apparent, are the result of prolonged inquiry.

It is obvious from these that there were remarkable differences between the attack-rate, case-mortality, age at death, and death-rate of small-pox, as it occurred among unvaccinated persons in Warrington 1892–1893, and among vaccinated persons in Warrington 1892–1893; and, also between the disease as it occurred among the population of Warrington in 1773, and among those vaccinated persons who were attacked in 1892–93. (*See* three accompanying charts.)

It is also obvious that there are certain points of similarity between the disease as it arose amongst the population of Warrington in 1773, and amongst those persons who were unvaccinated in 1892–93.

After exhausting every possible source of information, I was unable to ascertain any adequate cause for these differences and points of similarity, excepting the circumstance that the several groups of persons were respectively vaccinated or unvaccinated.

PART III.

Special Preventive Measures—Recognition, Notification, Disinfection, Removal, Isolation, and Hospital Provision. The Question of Aërial Spread.

This part of the Report on the Warrington small-pox epidemic, 1892–3, will refer to those preventive measures which are specially applicable to infectious diseases, and particularly to a highly infectious malady like small-pox. The facts will be grouped under seven headings :—

		Page
I.	Recognition and notification - - - - - - - - - -	56
II.	Removal of patient - - - - - - - - - - - -	59
III.	Disinfection of infected house and quarantine of friends and schools - - - - -	60
IV.	Hospital provision. Description of the Old Borough Fever Hospital, Aikin Street - - -	61
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SECTION I.—RECOGNITION AND NOTIFICATION.

SUB-SECTION *a*.—RECOGNITION OF SMALL-POX.

It is, I believe, customary in the present day to epitomise the special means to be adopted for the prevention of small-pox in three words — vaccination, isolation, and disinfection. But it will be seen, by a perusal of the narrative of the outbreak (Part I.), what an extremely important part non-recognition of the malady played in the causation of this epidemic.

1. It will be seen on p. 8, *ante*, how three of the four cases forming the preliminary outbreak in May were imported into Warrington owing to the non-recognition by the doctor of the case which formed the source of their infection, in Clifton, near Brighouse, Yorkshire. There is no evidence as to the type of the non-recognised case; but he was said to have been sufficiently ill to be confined to bed for a few days. Fortunately these were only followed by one secondary infection.

2. It will also be seen, on p. 9, *ante*, that three out of the 15 cases forming the 2nd group of the larger epidemic commencing in August, were seen by a doctor's assistant, who failed to recognise the malady for ten days, seven days, and altogether, respectively. There is good evidence to show that two of these were well-marked types of the affection. The disastrous results of the non-recognition of these cases are sufficiently set forth in the narrative of the succeeding events.

Causes of non-recognition.

It is difficult, and in many instances impossible, to distinguish delay in recognition from delayed notification due to other causes. Taking both of these together there were, during the epidemic from May 1892 to May 1893, 112 cases where recognition or notification was delayed for two or more days after the appearance of the eruption.

Difficulty in diagnosis.

Small-pox in its classical form is one of the very easiest of diseases to recognise. Its sudden advent in a person in previous health, its marked symptoms, its typical eruption, are unmistakable; it may seem, therefore, a little remarkable that so many cases should have been overlooked.

Nevertheless the majority of the cases of delayed recognition were of a mild type. Out of the 667 cases observed 329 have been classed as mild (modified or varioloid); and this type of case, which seems to predominate in the present day, undoubtedly may present very great difficulties in diagnosis from such diseases as measles, varicella, acne, and what the people call "heat bumps" or "pimples."

One case developed only three or four "pimples" on his face, attended with so little constitutional disturbance that it never occurred to him to cease work. Yet the case was undoubtedly one of small-pox and other cases subsequently arose in the house.

In the early stage of the epidemic, the patients and their friends, owing to their ignorance and neglect of any but a marked illness, sometimes failed to send for a doctor until the disease was advanced. This rarely happened in severe cases, generally the cases were mild (6, 8, and 30*a*, p. 10). But even in the mild variety the pain in the back preceding the eruption, usually made them seek medical aid. This symptom, in my experience, was rarely or never absent even in the mildest cases.

At a later period of the outbreak especially when medical aid was difficult to procure, the people frequently recognised and notified the condition themselves.

As regards the other diseases mistaken for variola, nine persons were taken into the Small-pox Hospital suffering from other diseases erroneously diagnosed as small-pox :—

5 cases of varicella,
2 cases of scarlatina,
1 case of acne, and
1 case of "erythema" (or ? measles).

Only one of these, the last-named, contracted small-pox (Case 574*a*.) from the procedure. They had all been re-vaccinated either shortly before or on admission. The man who thus contracted small-pox (Case 574*a*), æt. 35, was admitted with erythema or (?) measles on March 15th; was re-vaccinated by the Assistant Medical Officer of Health twice, on 17th and 19th of March, both times unsuccessfully, and developed the eruption of small-pox on April 1st—17 days after his first admission and 15 and 13 days respectively after the dates of his unsuccessful re-vaccinations.

SUB-SECTION *b*.—NOTIFICATION.

Notification has been in force in the borough of Warrington since the passing of a special Act, "The "Warrington Corporation Lighting and Improvement "Act, 1879." Sections 23, 24, and 25 of that Act impose the responsibility of notifying infectious disease on both the doctor and the householder. When the epidemic was at its height many cases were notified without waiting for a doctor, but in most cases the duty devolved on the medical attendant.

Procedure.

Notices of infectious disease are directed to be "sent by post or otherwise" addressed to the Medical Officer of Health at his office at the Town Hall.

Upon receipt of such notice, the Medical Officer of Health, after visiting the case, gives directions for an ambulance to be sent to fetch the patient. The Medical Officer of Health does not reside at the Town Hall, and it is possible that slight delay may have arisen in this way.

Unnotified Cases.

Out of a total of 667 cases, 16 were never notified, either by the doctor or by the patient's friends, but were discovered subsequently by other means. Such cases have been indicated by the letter *a* after the number. Thus 97·6 per cent. of the persons known to have suffered from small-pox were notified to the authorities. This is a higher proportion than is usual in severe epidemics. Table XL. at foot gives particulars of the unnotified cases.

The majority of the unnotified cases occurred in the early part of the epidemic, 8 of them in the first three months.

Twelve of the 16 unnotified cases were of the mild, modified, or varioloid type, and seven of these were of a very mild and trivial kind.

Three others were discrete. Only one case was confluent, a baby, born on the day its mother developed the eruption, who was admitted with its mother to hospital and was vaccinated four days later, developed the eruption four days afterwards, and finally died five days later.

Causes of Non-notification.

As regards the causes of their being unnotified, five persons did not feel sufficiently ill to induce them or their friends to seek medical advice at all. Four other cases were supposed by their medical attendant to be chicken-pox, and the mistake was only subsequently discovered, generally after small-pox had occurred in others with whom they were associated. One case was not recognised by the doctor's assistant; three were already in hospital; and in three the reason of non-notification was undiscoverable.

TABLE XL.

GIVING PARTICULARS OF THE 16 UNNOTIFIED CASES.

No. of Case.	Book and Page.	Name and Age, and Residence where Rash appeared.	Date of Rash.	Type of Case.	Reason of Non-notification.
6*a*.	V. / 2	H——, Haywood, 31 -	17 / VIII.	Very mild - -	Not recognised by doctor's assistant.
30*a*.	VII. / 11.	M——, Agnes, 21 -	20 / VIII.	Very mild - -	Not ill enough to consult a doctor.
55*a*.	IV. / 23	J——, Ada, 9 - -	12 / IX.	Mild - -	Supposed varicella in Fever Hospital at the time.
60*a*.	IV. / 24	O'D——, Jimmy, 10 -	12 / IX.	Very mild - -	Ditto ditto ditto.
69*a*.	I. / 2	B——, Alice, 14 - -	21 / IX.	Very mild - -	Not ill enough to consult a doctor.
148*a*.	I. / 2	B——, Charlotte, 20 -	8 / X.	Very mild - -	Ditto. ditto.
	IV. / 1	C——, Elizabeth, 13 -	26 / X.	Discrete, deeply pitted	Already in Fever Hospital.
239*a*.	XV. / 20	S——, Charles, 10 -	30 / X.	Very mild - -	Not ill enough to consult a doctor.
302*a*.	IV. / 2	M——, Annie, 7 -	9 / XI.	Discrete - -	Already in Fever Hospital.
376*a*.	II. / 16	L——, Jos., 8 - -	? Sept.	Mild - -	Supposed varicella.
377*a*.	II. / 13	L——, John Jas., 4 -	? Sept.	Mild - -	Supposed varicella.
416*a*.	XI. / 24	R——, Richard, 17 -	29 / XI.	Very mild - -	Unknown.
442*a*.	XV. / 25	H——, Annie, 30 -	3 / XII.	Mild - -	Unknown.
461*a*.	XI. / 13	E——, Mary, 13 days -	16 / XII.	Confluent - -	Born, developed eruption, and died in Small-pox Hospital.
574*a*.	XIV. / 33	B——, James, 35 -	15 / III.	Discrete - -	Unknown.
639*a*.	XVIII. / 10	H——, William, 25 -	12 / IV.	Mild - -	Not ill enough to see a doctor.

Delayed Notification.

There were in the epidemic, besides the instances which were never notified at all, 87 other cases where notification was for some reason delayed for varying periods of time from two to six days after the eruption had appeared.

The cause of this delay in many instances was that the friends did not at first realise the necessity of seeking medical advice; but quite an equal number were due to a failure on the part of the doctor to promptly recognise the complaint, or, recognising it, to promptly send notice.

It is not possible to give a statistical statement of the ratio of these two causes, but the above may be taken as approximately correct. In certain instances both causes were in operation.

An undue proportion of these 87 infected houses contained second cases. But the number is too small to examine whether the delay modified the course of the disease.*

Concealed Cases.

Case 260, which is not included in the above list, was not notified till after death, for it was concealed by the parents. It was an unvaccinated child, Sarah M———, æt. 8, who developed the eruption of what seemed to have been confluent small-pox about October 20th, and died at home on November 3rd. At a coroner's inquest, held on November 5th, the verdict brought in was, "Death by small-pox, accelerated by neglect of the mother."

At the time of my visit to this house, on a Sunday morning, both parents were intoxicated.

There was only one other prosecution for concealment by a householder undertaken during the epidemic. In the month of March action was taken against a lodging-house keeper for sending away his son (Case 523) to Ireland without notification. The result was conviction and fine.

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* There was a fact in reference to scarlet fever, showing the effects of compulsory notification, which was incidentally revealed, and which is mentioned in Part I., p. 7, *ante*.

SECTION II.—REMOVAL OF PATIENT.

SUB-SECTION *a*.—METHOD OF REMOVAL.

Ambulances were provided at the time of my visit on December 1st, at both the Old Hospital (Aikin Street), which then contained only scarlet fever cases, and the New (Temporary) Hospital which received only small-pox cases, for the transference of these diseases respectively. But at an earlier date the one ambulance kept at the Old Fever Hospital was made to serve for both diseases, scarlet fever and small-pox. The footnote (†) to the table on p. 12, *ante*, may be referred to in this connection. In that instance a child suffering from scarlet fever developed the rash of small-pox 13 days after removal to the Old Fever Hospital, in the same ambulance as a small-pox patient had, it was alleged, been taken just before.

Up to the latter part of November one man, the caretaker at the hospital, did the whole of the removals for all classes of infectious diseases, and with the same ambulance. The same person did the house and furniture disinfection in the town, and superintended the disinfection of bed and bedding, which was all done at Aikin Street. He is previously referred to on p. 11. A horse and driver were hired for each occasion from a cab proprietor in the town.

After the latter part of November an additional ambulance was kept at the New Hospital, and a nurse sent out with it. A horse and man still being hired from stables in the town.

Owing to the habits and mode of life of the people among whom the disease occurred, it was not possible to look for anything approaching isolation in the patient's own home. The question, therefore resolved itself into one of removal to hospital.

SUB-SECTION *b*.—DELAYED REMOVAL.

Out of the 667 cases, 133 (20 per cent.) were delayed in their removal to hospital for two or more days after the appearance of the eruption, and some of these were never removed at all.

Causes of delayed Removal.

It is evident that delay in the isolation of a case may arise from three causes:—1. Non-recognition of the disease either by friends or doctor. 2. Delay in notification on the part either of friends or doctor. 3. Delay in removal after notification either by obstruction of friends, inaction of authorities, or the absence of hospital accommodation. The first two causes have already been dealt with, and it remains now to examine the third, eliminated as far as possible from the other two.

As far as my information goes, the instances of the delay in isolation were distributed as follows:—

1.—Owing to deficient hospital accommodation, there were 91 cases left at home, either altogether or for periods varying from 2 to 22 days, after the rash had appeared and the case was notified.

The limit of accommodation for small-pox in the *old fever hospital* was reached on August 23rd, and between this date and the opening of the new temporary hospital, on September 19th, 46 cases lacked prompt removal in the above sense.

On November 12th the limit of hospital accommodation was for a second time reached, in spite of the conversion of the disused ironworks into a *temporary hospital*. From this date, during November and part of December, 45 cases were left at home for varying periods owing to this cause.

Delays in recognition and notification are for the most part not included in the above 91 cases, which form, it will be seen, nearly three-fourths of the 133 instances of delayed removal.

2.—Ten persons admitted that they had refused to be removed.

3.—Various causes accounted for the remaining 32, such as the patient being too ill for removal, delayed action by the friends, some accidental cause, or reasons undiscoverable.

Effects of delayed Recognition, Notification, and Removal.

The effects of delay in removal might be measured in three ways:—

1. By comparing the number of second cases which arose in the infected houses, where delay occurred, with those in which removal was prompt.
2. By comparing the attack rate in these two groups of houses.
3. By comparing the case-severity and death-rate in these two groups of houses.

The first two would show the influence of delay on the spread of small-pox, and the last the influence on severity of the disease.

But it is obvious that these results would be considerably modified by the length of delay, *i.e.*, the duration of exposure, overcrowding, age of patient, and many other sources of fallacy; and as the figures are not large enough to admit of an analysis which would eliminate these sources of error, it is undesirable to attempt in detail thus to measure the effects of the delay.

SECTION III.—DISINFECTION OF INFECTED HOUSE AND QUARANTINE OF RELATIVES.

Sub-section *a*.—Disinfection of House.

After removal of the case, the house and furniture were subjected to disinfection with more or less promptitude and more or less efficiency.

The house disinfections were carried out by the caretaker at the Aikin Street Hospital, or under his supervision. I had several opportunities of witnessing the performance.

During the process of burning sulphur ("stoving," as the people called it) the inmates were of necessity turned out of the house, when, as is usual, the house was small.

The mother of Case 144 affirmed that she had—" seen people in this street when disinfection was being " done in their houses take their furniture to neigh-" bours' houses, so that it should not be affected by it."

The bedding and infected articles were conveyed to the disinfector at Aikin Street Hospital, where a new Lyon's steam disinfector was erected, and used on December 1st, 1892. Before that date hot air alone was employed, and as the time required for this is considerable and the pressure of work great, the result was not always satisfactory.

Delayed Disinfection.

Altogether 52 instances of alleged delay or error in disinfection came under notice, of which the following are illustrations :—

The bed of Case 185 was not taken till three weeks after removal. The father of the case developed the disease in the same house 19 days after his daughter.

Case 110 occurred in a house which was not disinfected for two weeks; 16 or 17 days after the first, two other cases arose.

The house of Case 180 was not disinfected at all. Between two and three weeks later another (fatal) case occurred in the same house.

The house where Case 81 occurred was not disinfected for 14 days after removal. The house was rather overcrowded (nine inmates), and four other cases arose therein within the three weeks succeeding the removal of the first.

These were some of the instances which occurred during September and early October, when the outbreak was of moderate dimensions.

Later on, when the resources of the borough were taxed so severely, it would be only natural that delay and defect should occasionally occur. Nevertheless, the majority of the 52 instances of delayed or faulty disinfection seem to have occurred in September and October. The following table shows the chronological distribution of these instances :—

1 in	August	1892,	when	20	cases arose.
16 ,,	September	,,	,,	104	,,
13 ,,	October	,,	,,	134	,,
11 ,,	November	,,	,,	184	,,
5 ,,	December	,,	,,	56	,,
3 ,,	January	1893	,,	40	,,
1 ,,	February	,,	,,	28	,,
1 ,,	March	,,	,,	42	,,
1 ,,	April	,,	,,	46	,,

Sub-section *b*.—Quarantine of Friends.

In the preliminary outbreak of four cases in May (Part I., p. 8), quarantine was very thoroughly carried out, for, owing to the isolated position of the house, and the good sense and the friendlessness of these newly-arrived people, isolation of the whole family before removal was a natural consequence. Subsequently, the only person in the household who escaped—the mother—voluntarily went into hospital with her husband and two children. *It may fairly be taken that this was one of the reasons why this preliminary outbreak spread no further.* One of the two men employed in the disinfection was the only case secondary to these.

With this exception, no measures for the actual removal and isolation of the healthy members of an infected household were adopted during the Warrington epidemic.

Nevertheless, the people were enjoined both to keep away from the patient, and not to mix with other folk. It is extremely doubtful if even a small proportion obeyed these injunctions. I was informed by the medical officer of health of one instance where a woman collected her friends to take a farewell cup of tea prior to her removal to the hospital with small-pox; and another instance where children were fetched home from school to bid their father good-bye prior to his removal to the small-pox hospital.

After October notices were sent from the Health Office to the employers of the rest of the family, and to the schools where the children went, after the removal of the case, and in many instances the workpeople stayed away one or two weeks.

Sub-section *c*.—Schools.

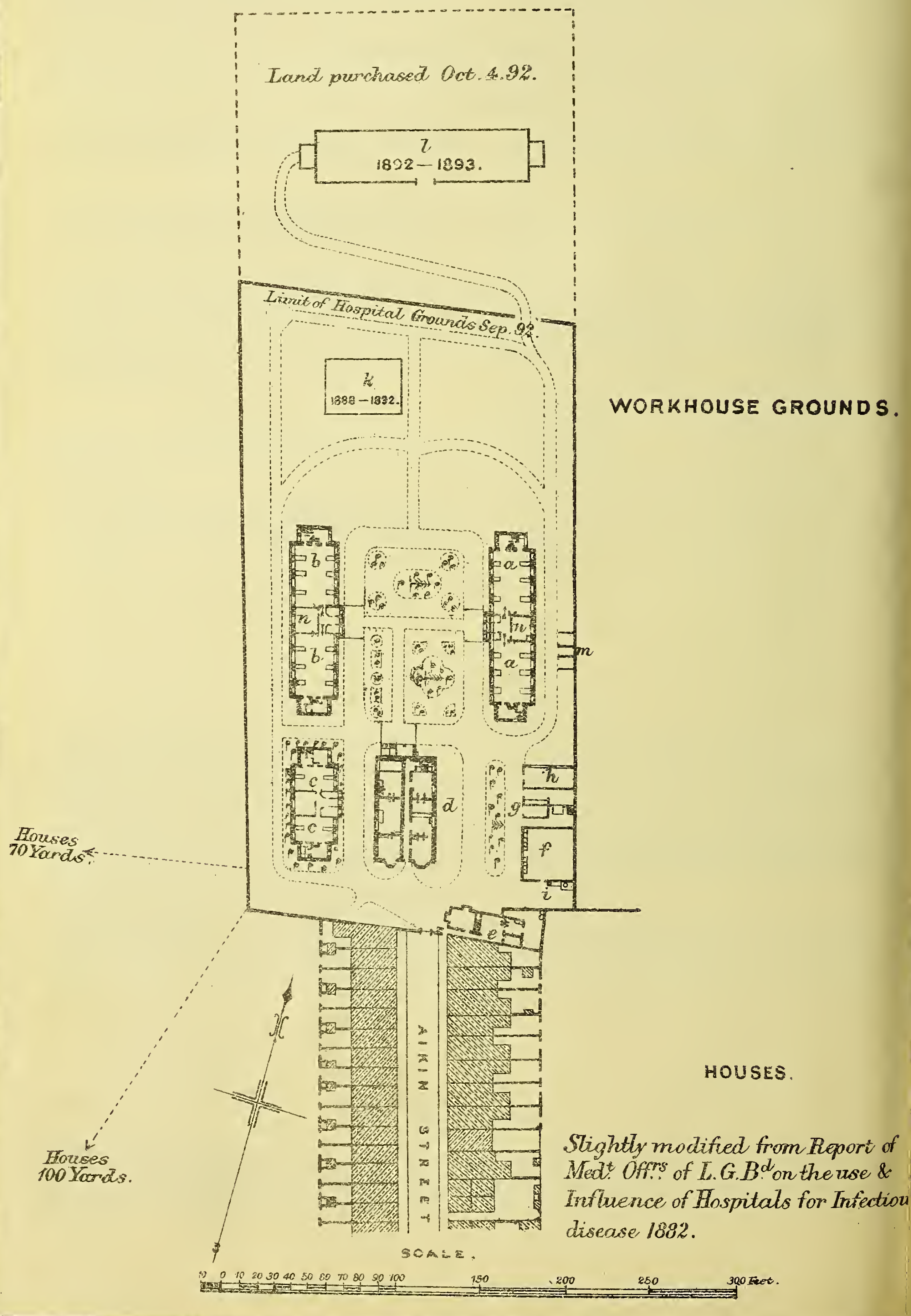
It was not thought desirable to close the schools at any time during the epidemic, and, as may be seen in Part II. (p. 49), the children among the vaccinated persons were themselves freer from attack than any other age period under 40; though it would seem probable that their playing on the open spaces, especially about the hospitals, was a fruitful source of mediate contagion.

faces p. 61.

BOROUGH OF WARRINGTON

INFECTIOUS DISEASES HOSPITAL.

AS ERECTED IN 1877 AND ADDED TO IN 1888 AND 1892.


Land purchased Oct. 4. 92.
l
1892—1893.
Limit of Hospital Grounds Sep. 92.
k
1888—1892.
WORKHOUSE GROUNDS.
b
n
b
a
n
a
m
c
c
d
h
g
f
i
e
Houses
70 Yards
Houses
100 Yards.
AIKIN STREET
HOUSES.
SCALE.
10 0 10 20 30 40 50 60 70 80 90 100 150 200 250 300 Feet.

Slightly modified from Report of Medᵗ. Offʳˢ. of L. G. Bᵈ. on the use & Influence of Hospitals for Infectiou disease 1882.

Wyman & Sons, Lᵗᵈ, Lith. 574

SECTION IV.—HOSPITAL PROVISION; OLD BOROUGH FEVER HOSPITAL (AIKIN STREET).

Sub-section *a.*—History and Description of Hospital.

The hospital for infectious diseases for the borough of Warrington was opened in May 1877, and a full description of it, by Dr. Thorne Thorne, as it existed in 1881, will be found in the Report of the Medical Officer to the Local Government Board, on "The Use and Influence of Hospitals for Infectious Disease," published in 1882 (p. 272).

The site is an irregular oblong, covering nearly two acres in extent, situated at the northern (blind) end of Aikin Street, which forms its only means of approach, in what is rather a thickly-populated part of the town. The accommodation in 1882 was 28 beds, with an average cubic space per bed of 2,040 cubic feet.

1888.

In 1888 a Doëcker hut (*k*) was erected on the northern end of this ground, to contain two beds.

1890.

On August 14th, 1890, the Warrington Extension and Water Act, 53 & 54 Vict., received the Royal Assent. Section 84 runs as follows :—

> "(1.) For the purpose of enlarging their existing hospital for infectious diseases or of otherwise providing increased accommodation for persons suffering from any infectious disease, the Corporation may enter on take and use such of the lands delineated on the deposited plan and described in the deposited book of reference, as they may require for that purpose.
>
> "(2.) The power of taking land under the provisions of this section shall not be exercised after the expiration of two years from the passing of this Act."

At this date and afterwards the Medical Officer of Health frequently urged the desirability of better provision for infectious disease, but the purchase of additional ground was not completed till October 4th, 1892, at a time when the small-pox epidemic had a complete hold on the town, and the building (*l*) was not erected till the latter part of that month.

Thus, in May 1892, when the small-pox epidemic commenced, the actual provision for the isolation of of infectious disease arising within the borough, comprising a population of 54,084 consisted of 30 beds.

On September 19th, 1892, the disused ironworks were openedas a temporary hospital (p. 64). The various other steps taken by the authorities when in presence of the epidemic of small-pox are set forth in the narrative of the epidemic, pp. 8 to 17, *ante*.

1892.

On August 26th, 1892, the Doëcker hut (*k*) was accidentally burnt down.

1893.

The new pavilion (*l*) was accidentally burnt down seven months after its erection, May 1893.

Receiving Ward.

Herewith is submitted a plan of the Warrington Infectious Disease Hospital as erected in 1877, and added to in 1888 and 1892, with explanation.

The structure and arrangement of the old buildings are good. They are fully described in Dr. Thorne Thorne's report (*op. cit.*). The new pavilion on the piece of ground at the northern end was built of wood, sawdust lined. Otherwise its arrangements were the same as the existing pavilions.

It will be observed that receiving ward accommodation—where a patient can be received and quarantined pending the arrival of the doctor, and pending his decision as to the nature of the disease, and where patients and visitors can be disinfected prior to discharge—has never been provided.

Two cases of small-pox (65 and 75) were notified by practitioners as scarlet fever, and therefore taken direct into the scarlet fever ward, until it was discovered that they were suffering from small-pox.

It has been mentioned (p. 56, *ante*) that instances of other diseases were brought to the small-pox hospital by mistake, and that one of these contracted the malady.

The accompanying Table XLI. shows the provision in different years for the isolation of all kinds of infectious disease in Warrington from 1886, when the fever hospital was opened, to 1892.

TABLE XLI.

Showing the Provision for the Isolation of Infectious Diseases of all kinds in Warrington, from 1886 to 1892.

Year ending Mid-summer.	Population.	Number of Beds for Infectious Diseases.	Average Cubic Space per Bed in Cubic Feet.	Proportion of Beds to Inhabitants.
1886 -	46,343	28	2,200	1 to 1,655
1887 -	47,264	28	2,200	1 to 1,688
1888 -	47,464	30	2 200	1 to 1,582
1889 -	49,000	30	2,200	1 to 1,633
1890 -	50,000	30	2,200	1 to 1,666
1891 -	53,000	30	2,200	1 to 1,758
1892 -	54,084	30	2,200	1 to 1,800

Borough of Warrington Infectious Diseases Hospital.

a. a.—Two wards, each measuring 36′ by 24′ by 14′, each for six beds. Commonly used for acute scarlet fever cases. Cubic space, 2,016 cubic feet per bed.

b. b.—Two wards, each measuring the same as *a. a.* Each for six beds. Commonly used for convalescent scarlet fever patients.

c. c.—Two special wards, used for typhoid or small-pox cases. Two beds each. Each ward giving 2,529 cubic feet per bed.

d.—Administrative building, where nurses and matron reside. Also contains laboratory of Medical Officer of Health, who is Public Analyst.

e.—Entrance lodge, where the hospital keeper resides.

f.—Laundry.

g.—Disinfecting stove; Ransom's patent till Dec. 1892, when it was replaced by a Lyon's steam disinfector.

h.—Mortuary.

i.—Van shed.

k.—Doëcker hut erected in 1888, burnt down August 26th, 1892 ; measuring 24′ by 15′ by 10′ (3,600 cubic feet). Two beds.

m.—Tool shed.

n.—Nurses' day or duty rooms.

The original ground, on which all the above stand, is nearly two acres in extent.

l.—New pavilion, erected October 1892, having same measurements as pavilions *a. a.* and *b. b.* 12 beds. It stands on a piece of ground nearly one acre in extent, purchased October 4th, 1892. This building was burned down in May 1893.

SUB-SECTION *b*.—STAFF AND ADMINISTRATION (AIKIN STREET HOSPITAL).

Staff and Administration.

The general and medical administration of the hospital is in the hands of the Medical Officer of Health, who visits the hospital for this purpose. He is, in this capacity, immediately responsible to the Health Committee of the Town Council.

The chief resident official is the matron. The present holder of the post, had not, I was informed, had any previous training or nursing experience, prior to her appointment to the hospital in 1887. The same information also applies to the nursing staff (p. 12).

Nurses were engaged as occasion arose. On the day of my visit there were three on duty. An extra nurse was employed to attend the patients in the Doëcker hut before it was burnt down, and she resided there then.

The only male resident is the caretaker, who also superintends the disinfection of clothes, and the fetching of patients in the ambulance.

After the escape of R —— (Case 1) on July 30, a man (Case C.) was temporarily employed as night attendant.

I made inquiries into the movements of the staff, but was not convinced of the impossibility of infection by these means. After the opening of the new hospital (September 19) until the middle or end of November no sleeping accommodation could be provided in the later, so the assistant medical officer and the rest of the staff slept at the old hospital and went backwards and forwards daily to the new hospital, mostly, I was informed, in a cab.

It was said to be the practice to re-vaccinate officials on their appointment, but the two who contracted small-pox (p. 12) had not been re-vaccinated.

Nor were the scarlet fever patients re-vaccinated on the outbreak of small-pox amongst them. There were amongst these latter three unvaccinated persons who contracted small-pox:—

> Case 227*a*, æt. 13, Case 391, æt. 3, and Case 390, æt. 3, who left the scarlet fever hospital on Nov. 7, and developed the eruption of small-pox on 20th.

A description of the spread of small-pox among the patients and staff of the Aikin Street hospital is given fully on pp. 11 and 12 *ante*, and is briefly referred to below.

Removals and Disinfection.

Removals for all kinds of infectious disease were conducted from the ambulance station at the Aiken Street Hospital, and all the clothes and bedding were taken for disinfection to this hospital, throughout the epidemic. Until November, all cases of all kinds of infectious disease were removed in the one ambulance kept at Aikin Street.

Visitors.

According to the evidence of the visitors, they were not *at first* submitted to much regulation, and were allowed ingress and egress without changing of clothes, or putting on overalls. Valuable information as to the date of appearance of the small-pox rash in Case 302*a* was afforded by the mother of that patient, who visited her child in the hospital. Case 391 was another instance of the same kind.

SUB-SECTION *c*.—SCARLET FEVER EPIDEMIC, 1892.

Scarlet fever is endemic in Warrington. A table of the annual notifications of this disease will be seen on p. 63.

December 1892.

At the time of my visit to the Aikin Street Hospital on December 1, 1892, there were four structures planned to accommodate 40 patients, pavilion *a a* (plan, p. 161. *ante*) arranged for 12 beds, *b b* for 12 beds, *l* for 12 beds, and *c* for four beds.

In the first three pavilions I found an aggregate of 99 beds erected, and occupied by this number of scarlet fever patients, 51 adults and 48 children. This reduced the cubic space to about 720 cubic feet per bed. In the smaller building *c* there were three or four convalescents from small-pox. All the other small-pox patients had been sent to the temporary small-pox hospital on September 19th, but these were cases that had arisen among the scarlet fever patients.

The Medical Officer of Health has supplied me with the number of scarlet fever patients admitted to hospital in the respective months during the year 1892:—January, 12; February, 10; March, 11; April, 25; May, 38; June, 51; July, 50; August, 48; September, 58; October, 57; November, 28; December, 13; total for the year, 401.

The Medical Officer of Health also informed me that the average number in at any one time was between 70 and 80.

SUB-SECTION *d*.—SMALL-POX CASES ADMITTED TO AIKIN STREET HOSPITAL.

Provision was made in the Doëcker tent (*k*) until it was burnt down on August 26, 1892, and in the special pavilion (*c*) for a maximum number of 13 small-pox cases at one time. Small-pox cases were admitted to Aikin Street Hospital up to August 23rd. Those which arose after that date were left in their own homes, with a few exceptions, until September 19th. On this day the new temporary hospital was opened and the cases from the old hospital transferred to it; only those which had arisen in the old hospital among the scarlet fever patients being left there. Table XLIII., p. 64, shows the number of cases of small-pox admitted, discharged, and remaining in hospital each week, from particulars kindly supplied by the Medical Officer of Health.

SUB-SECTION *e*.—SPREAD OF SMALL-POX WITHIN THE AIKIN STREET HOSPITAL AMONG THE SCARLET FEVER PATIENTS AND THE STAFF.

In Part I. the incidents connected with the spread of small-pox among the scarlet fever patients and staff are mentioned (pp. 11 and 12), and a table of cases given.

The attack-rate among them was 4·7 per cent. (excluding two doubtful infections) out of 232 persons, as compared with 1·2 in the rest of the town as a whole, and ·8 among the inmates of the workhouse next door, albeit the hospital contained so large a number of the best protected decade of life among the vaccinated. The densely overcrowded state of the hospital—doubtless unavoidable *at the time* but nevertheless dangerous—is sufficient to account for this.

The first to contract the disease was the kitchen-maid, who fetched and washed the plates used by the first small-pox patient, case 1. At the same time a little scarlet fever patient also developed it. Unfortunately this latter was moved, doubtless owing to want of accommodation, over to the nurse's duty room in the middle of the other pavilion (*b b*), in which building the nurse, and six of her scarlet fever patients developed the small-pox in succession.

SUB-SECTION *f.*—MEASURE OF HOSPITAL REQUIREMENTS.

As a consequence of the long-delayed action of the Town Council to provide adequate hospital accommodation for the isolation of infectious diseases (pp. 8, 9 *et seq.*, and pp. 16, 17, and 61) the actual state of matters on November 10, 1892, was as follows. There were on this day 80 cases of scarlet fever and 156 cases of small-pox to be dealt with, making a total of 236 cases of highly infectious disorders, to isolate in a hospital certified to contain 30 beds. It is quite certain that if adequate hospital provision for the isolation of infectious diseases been made these figures would never have been reached, and the expenses and other consequences of the small-pox epidemic would have been almost entirely avoided.

In order to arrive at the requirements of Hospital accommodation for the isolation of infectious disease, it is necessary to know—

(1) the average annual number of cases of the several diseases requiring isolation, and
(2) the average length of stay in hospital of each disease respectively.

Information about the first can be obtained from Table XLII. (below); and the Clerk to the Asylums Board of London has kindly supplied me with the average length of stay in the hospitals of that Board of patients suffering from the four chief infectious disorders as follows—

Small-pox cases - - -	5 weeks
Scarlet fever - - -	10 weeks
Diphtheria - - - -	6 weeks
Enteric fever - - -	9 weeks

These figures relate only to cases treated in the hospitals to recovery.

There are three infectious diseases which seem to be constantly present in the borough of Warrington and which certainly require isolation, scarlet fever, diphtheria, and enteric fever; and it will be seen from Table XLII. that the average number of cases notified per annum of each of these disorders for the four years 1889–92, was respectively 241, 18, and 36. The hospital requirements for these three diseases may therefore be estimated as follows—

$$\text{Scarlet fever}\quad 241 \div \frac{52 \text{ weeks}}{10 \text{ weeks}} = 46 \text{ beds}$$

$$\text{Diphtheria}\quad 18 \div \frac{52 \text{ weeks}}{6 \text{ weeks}} = 2 \text{ beds}$$

$$\text{Enteric fever}\quad 36 \div \frac{52 \text{ weeks}}{9 \text{ weeks}} = 6 \text{ beds}$$

Total for three diseases - 54 beds

In view of the social class amongst whom these disorders arise in Warrington (see p. 81 *et seq.*) it is fair to presume that all these cases notified ought to be isolated, and it seems also fair to assume that the average period of stay in hospital should correspond with that based upon the experience of the Hospitals of the Metropolitan Asylums Board of London.

It should, moreover, be remarked that the estimate of 54 beds as the isolation needs of the Borough of Warrington only provides for the *three* principal infectious disorders constantly prevalent in the town, and takes no account of measles, which is also constantly present and occasionally taken into the Borough Fever Hospital, and which caused an average in six years of 59 deaths per annum; nor does it provide for typhus fever, or small-pox, some provision for which diseases is undoubtedly necessary.

Nor does this estimate of 54 beds take into account the important factor of seasonal incidence, nor epidemic prevalence, of these *three* diseases. It does not allow for cases or outbreaks of small-pox or other infectious disease, nor for the future growth (*see* p. 84) of the town.

In order, therefore, *to cover the actual current needs of the Borough to provide for infectious diseases needing isolation—allowing only* 10 *beds for measles, small-pox, and typhus—at least* 64 *beds are absolutely necessary.* Thus:—

Scarlet fever - - -	46 beds
Diphtheria - - - -	2 beds
Enteric fever - - -	6 beds
Measles, small-pox, and typhus - - - -	10 beds
Total -	64 beds

Whereas the hospital provision at the present time (1893) *is barely half this number, or* 28 *beds.**—It is therefore not to be wondered at that the cases of small-pox, as they arose, were unable to be isolated, and that on this account the small-pox epidemic of 1892–93 reached the alarming proportions which it did.

It is customary to reckon in the abstract that 1 bed per 1,000 population is required for isolation purposes, and even by this method Warrington would require 54 beds, or nearly twice the number at present provided.—But as compulsory notification has been so long in force at Warrington one is able to gauge with unusual accuracy the actual requirements of the borough, and the result of this calculation shows that 64 beds is the irreducible minimum of such actual requirements at the present time (1893), without allowing for future growth of the population, which would be at the rate of seven additional beds for the next five years.

Finally, if it were proposed to accommodate, by courtesy or arrangement, the neighbouring Rural Sanitary District a larger provision than this would be requisite.

TABLE XLII.

NOTIFICATION TABLE showing details of the several CASES NOTIFIED (or DEATHS) from the seven principal Infectious Diseases in WARRINGTON, 1886–1892; from the Medical Officer of Health's Annual Reports.

—	Small-pox.	Scarlet Fever.	Measles.†	Diphtheria.	Typhus.	Typhoid and ill-defined or continued "Fever."	Whooping Cough.
Year ending Dec. 1886	0	10 cases	227 *houses*	5 cases	3 cases	23 cases	0
1887	0	74 „	134 *deaths*	4 deaths	1 case	43 cases	46 *deaths*
1888	7 cases	660 „	1 *death*	5 deaths	8 cases	21 cases and 12 others "simple" and "continued."	58 *deaths*
1889	0	256 cases (mortality 12·5 per cent.).	91 *deaths*	10 cases	0	36 cases	32 *deaths*
1890	0	131 cases	33 *deaths*	27 cases	0	28 cases	56 *deaths*
1891	0	70 cases	80 *deaths*	21 cases	0	41 cases (29 enteric).	19 *deaths*
1892	490	510 cases	13 *deaths*	14 cases	0	39 cases	37 *deaths*

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* Since the burning down of the Doëcker tent.

† Measles is not notifiable, but is only occasionally removed to hospital.

SECTION V.—POSITION OF THE OLD BOROUGH ISOLATION HOSPITAL AND THE SPREAD OF SMALL-POX AROUND IT.

SUB-SECTION *a*.—POSITION OF HOSPITAL.

Map I. (at end) shows the position of the Old Fever Hospital at the northern end of Aikin Street. This street forms its only means of access, the hospital gates constitute in fact its northern boundary. Two of the houses abut on the hospital premises. This street has 79 houses, containing an aggregate of nearly 800 inhabitants, belonging entirely to the working classes.

Howard Street, where so many cases occurred, is the next street east of, and runs parallel to, Aikin Street.

Wakefield Street, where also a large number of houses became infected, lies parallel to and a little further east.

The workhouse is next door to the hospital on its east side, separated only by a high wall.

Altogether there is a population of 3,394 persons living within a radius of 300 yards of the Old Borough Fever Hospital, excluding the inmates of the workhouse.

Open Spaces.

There are three open spaces (marked *a*, *b*, and *c* on Map I.) where the children play and the neighbours gossip, close by the hospital.

Most infected District.

By far the most densely infected district of the whole town was a square-shaped area containing Howard Street, Wakefield Street, and Guardian Street, near the Old Fever Hospital. This area and *not the hospital itself* was the focus of the epidemic during August, September, and October.

Submitted herewith is a map of Warrington (too large for reproduction*) spotted with all the houses infected in August, September, and October, and it will at once be seen—

1. That at this time the White-Cross Ward (in the centre of which the old hospital is situated) was the most highly-infected district of the town.

2. That during these three months the infected houses congregate round a centre which lies neither in the hospital nor in the workhouse, but in space *b*, Map I. (*see* end). Two of the unisolated cases (Cases 10 and 13) seen by the doctor's assistant lived in Howard Street, abutting on space *b*, and a third (Case 6*a*) in Guardian Street (narrative, p. 9). These cases were the real causes of the high infection of this area.

3. That the condensation of infection during August and September is less noticeable than in October, when the infected houses became more uniformly scattered over the town.

SUB-SECTION *b*.—SPREAD ROUND THE OLD HOSPITAL.

In presence of such potent causes for the propagation in and around this hospital mentioned in the preceding pages (pp. 9 *et seq.* and above), it would be fruitless to inquire in any great detail into the part, if any, which aërial convection played in the spread around the Old Fever Hospital in Aikin Street.

Nevertheless it may be thought expedient to give—

(1.) A chart showing the proportionate numbers of houses infected at different distances from the hospital. These figures have been worked out with great care on the large scale map just alluded to. The various small scale maps produced at the end of this report may also be consulted if desired. It was often difficult owing to the lapse of time to trace the source of infection, but in the great majority of instances this was revealed.

(2.) A table (XLIII.) showing the numbers in hospital and workhouse, which being so contiguous, might form a collective centre for aërial spread.

(3.) The prevailing winds may be seen on p. 71 and in Table LX. on p. 95.

The question of convection by aërial currents will be dealt with in connection with the temporary hospital (p. 69). But it may be observed in passing—

1. That the numbers of infected houses do not work out in perfect keeping with a theory of proportionate distances from the hospital as a centre.

2. That the largest proportion of infected houses is to be found in the 2–300 yard S.E. quadrant (the one containing Wakefield and Howard Street), not in the quadrant opposite to the prevailing winds, S.W. and S.E.

3. The real centre of maximum infection is not the hospital itself but the open space beside the street where the unisolated cases, under the care of the doctor's assistant, resided.

The next largest in the two adjacent ones containing Howard and Aikin Streets.

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*10·56 feet to the mile.

TABLE XLIII., showing the Number of Cases of SMALL-POX remaining in HOSPITAL and WORKHOUSE each Week.

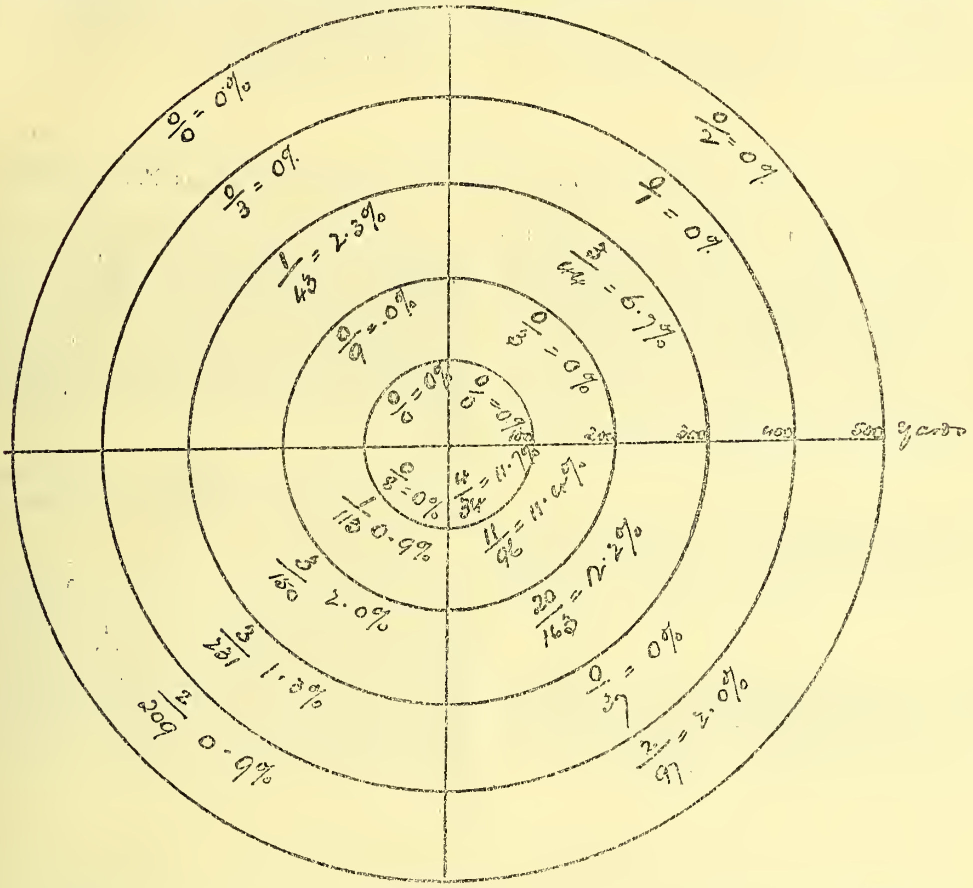
Week ended—	Forward from preceding Week.	Patients admitted.	Patients discharged or died.	Patients remaining in Hospital at end of Week.	Workhouse.	Total in the two Buildings.
Saturday, July 30, 1892 -	0	1	0	1	0	1
„ Aug. 6 „ -	1	0	1	0	0	0
„ „ 13 „ -	0	0	0	0	0	0
„ „ 20 „ -	0	4	0	4	1	5
„ „ 27 „ -	4	9	1	12	1	13
„ Sept. 3 „ -	12	3	2	13	1	14
„ „ 10 „ -	13	2	2	13	5	18
„ „ 17 „ -	13	1	3	11	5	16
„ „ 24 „ -	11	1	11*	1	4	5
„ Oct. 1 „ -	1	0	0	1	3	4
„ „ 8 „ -	1	0	0	1	5	6
„ „ 15 „ -	1	0	0	1	4	5
„ „ 22 „ -	1	1	0	2	3	5
„ „ 29 „ -	2	1	0	3	3	6
„ Nov. 5 „ -	3	0	0	3	2	5
„ „ 12 „ -	3	1	0	4	2	6
„ „ 19 „ -	4	0	0	4	2	6
„ „ 26 „ -	4	1	1	4	1	5
„ Dec. 3 „ -	4	0	1	3	1	4
„ „ 10 „ -	3	0	3	0	0	0

* Transferred to new hospital on Sept. 19th.

AIKIN STREET AREA.

PER-CENTAGE of INFECTED HOUSES in each ZONE and QUADRANT around the OLD FEVER HOSPITAL.

N.W. July 28th to October 4th, 1892. N.E.



S.W. S.E.

NOTE.—*Infected* houses form the numerators: *total* number of houses form the denominators of the fractions.

TABLE XLIV.

SUMMARY of AIKIN STREET AREA CHART.

Circles.	No. of Infected Houses.	Total No. of Houses in Area.	Per-centage of Infected Houses.
0—100 yards circle -	4	42	9·5
100—200 „ -	12	221	5·4
200—300 „ -	27	400	6·7
300—400 „ -	3	272	1·1
400—500 „ -	4	308	1·3
	50	1,243	Per-centage of whole area 4·0

Quadrants.	No. of Infected Houses.	Total No. of Houses in Area.	Per-centage of Infected Houses.
N.W. - - - -	1	55	1·8
N.E. - - - -	3	50	6·0
S.W. - - - -	9	711	1·2
S.E. - - - -	37	427	8·6
	50	1,243	

SUB-SECTION *c*.—BOROUGH HOSPITAL A DIRECT SOURCE OF INFECTION.

The foregoing results do not, on the theory of proportional distance, support the idea that the disease spread from the old hospital by means of aërial currents; there are, however, two circumstances which render it probable that the old hospital itself served as a means of direct infection:—

(1.) The escape of R——— during his delirium.

(2.) We have seen (page 11, *ante*) how the small-pox spread *within the hospital* amongst the scarlet fever patients therein, and how 4·7 per cent. of the various inmates, mostly of a well-protected age, were attacked; as compared with 0·8 per cent. in the workhouse adjacent, and with 1·2 per cent. in that town generally.

SUB-SECTION *d*.—FACTS AGAINST AËRIAL SPREAD IN AND AROUND THE BOROUGH FEVER HOSPITAL.

We have further seen that there were, near the hospital, several unisolated cases which, without doubt, formed the centre of a large series of direct infections. (Narrative, pp. 9–12, *ante*). In view therefore of these and other conditions rendering direct infection (both immediate and mediate) not only possible but certain, it seems unnecessary to assume any theory of conveyance by air currents from the Hospital. There is, moreover, one fact which renders it unlikely that the disease was spread through the air beyond, the limited distance mentioned in the Introduction (p. 3).

The Workhouse is situated close beside the hospital, the premises being separated only by a high wall, and the nearest Workhouse building is only 125 yards away from the small-pox block. This institution was early involved in the epidemic. Six cases arose in it during the epidemic.

The first case, a well-vaccinated child of four years, had alternative sources of direct infection, and all the others could be readily traced to direct infection from this case or from one another. A diagram and particulars of these are to be found on p. 13, *ante*.

Now between August and December there were 712 persons of different ages and conditions, exposed in the Workhouse to any aërial influences emanating from the hospital. Nevertheless, there were only ·8 per cent. of these attacked (as compared with 1·2 per cent. of the whole town), and in all but one of these a clearly established direct source of infection was known to have existed. In the solitary exception, the first case, there existed several alternatives of infection in the usual way.

If, therefore, the hospital formed a centre for aërial spread, it is most remarkable that all these 706 persons should have escaped attack.

As it might be thought that they were protected by re-vaccination, a table is given at foot (Table XLIV*a*.) showing the actual numbers re-vaccinated in the Workhouse, from which it will be seen that only 59 were so protected prior to September 19th, when the small-pox cases were removed to the temporary hospital in Dallam Lane. Nor was there any other condition which could have prevented these persons from contracting the disease aërially, had the principle of aërial convection been in operation.

SUB-SECTION *e*.—AËRIAL SPREAD FROM ONE PAVILION TO ANOTHER OF THE BOROUGH FEVER HOSPITAL.

As regards the theory of aërial spread of small-pox within the Hospital itself from one pavilion to another, a distance of 30 yards, we have seen (p. 11) that the facts are easily otherwise explicable. Case 3 arose in pavilion *a* (plan, p. 61), and was then removed, probably for purposes of isolation, over to pavilion *b*, in which a series of cases arose by direct or mediate infection from Case 3. The two other cases, not in this series, are equally well explained without the intervention of aërial convection (p. 11).

TABLE XLIV*a*.

Showing the number of inmates Re-vaccinated each week in the Warrington Workhouse, during the months of August, September, October, and November, 1892, out of a total of 712 who were within the Workhouse at the commencement of August (294 in number) or admitted subsequently; supplied by the courtesy of the Master, Mr. C. H. Ward.

During the week ended August 6th - - none were re-vaccinated.
,, ,, ,, 13th - - ,, ,,
,, ,, ,, 20th - - ,, ,,
,, ,, ,, 27th - - 1 inmate was ,,
,, ,, September 3rd - - 1 ,, ,,
,, ,, ,, 10th - - 21 inmates were re-vaccinated.
,, ,, ,, 17th - - 35 ,, ,,

On September 19th the Small-pox patients were transferred from the Aikin Street Fever Hospital to the Temporary Small-pox Hospital in Dallam Lane.

During the week ended September 24th - - no inmates were re-vaccinated.
,, ,, October 1st - - ,, ,,
,, ,, ,, 8th - - ,, ,,
,, ,, ,, 15th - - 1 inmate was ,,
,, 3 weeks November 5th - - no inmates were ,,
,, week ,, 12th - - 10 ,, ,,
,, ,, ,, 19th - - 15 ,, ,,
,, ,, ,, 26th - - 13 ,, ,,
,, ,, December 1st - - 1 inmate was ,,

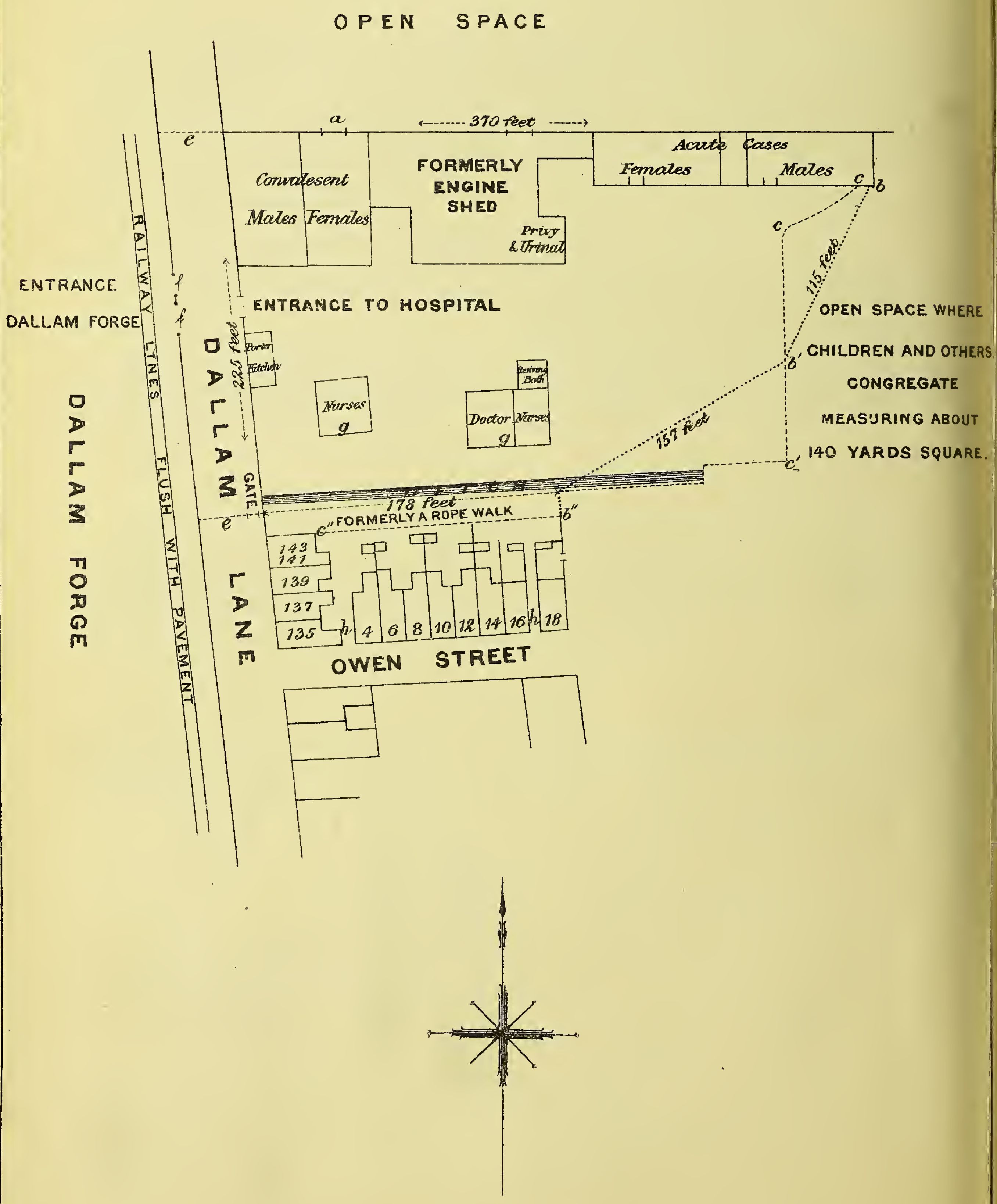
Total during the 3 months - 98

faces p. 67.

PLAN OF TEMPORARY SMALL POX HOSPITAL, WARRINGTON.

—— OPENED SEP. 19. 1892 CLOSED AUGUST 1893. ——

FORMERLY THE HAYDOCK IRON WORKS.



Scale Approximately 90 feet to 1 inch.

Wyman & Sons, Ltd, Lith. 5748.2.

SECTION VI.—NEW OR TEMPORARY HOSPITAL (HOPE HOSPITAL) IN DALLAM LANE.

Sub-section *a.*—Description of Hospital.

The circumstances which led to the establishment of this hospital, and its opening for the reception of small-pox patients on September 19th, 1892, were mentioned in Part I. of this report (p. 15, *ante*).

The building was formerly used as an iron works (the Haydock Iron Works), but it had not been occupied for some time. It was situated at the northern end of Dallam Lane near the northern fringe of the populated part of the town (*vide* map I., at end).

Communication with the outer world was obtainable up to about the middle of November, (*i.e.*, for 2 months after it was opened), through part of the palings on the east; and during the whole time the hospital was open over the low palings on the south side. In these latter there was even at the time of my visits in January and March, a large hole through which I easily passed over the ditch into the hospital confines.

Submitted herewith is a rough sketch of the premises, approximately to scale (90 feet to the inch). The explanation at the foot gives full particulars without the need of further description.

Sub-section *b.*—Capacity, and Staff.

By the courtesy of the Assistant Medical Officer of Health I was frequently enabled to visit the patients there. In December I always found the buildings very crowded. The beds were so close together as to scarcely leave room to pass between; yet, as already mentioned, the cases could not in November be received as fast as they arose.

When I first visited the building, on December 1st, there were 159 beds made up, all the males' beds were occupied and the most of the females'.

In the building devoted to acute cases (*see* plan) there were 37 beds and one cot on the females' side and 44 beds on the males' side; in the building devoted to convalescent cases there were on the first floor 28 females' and 28 males' beds, and on the ground floor 22 males' beds.

The following table (Table XLV.), supplied to me by the Assistant Medical Officer of Health, shows the numbers in hospital at the various week-ends:—

TABLE XLV.

Showing the Weekly Numbers of Small-Pox Patients in the Temporary Hospital.

Date of week-end.		Number in Hospital.
1892, September	27	65
„	28	67
„	29	68
„	30	84
October	1	81
„	3	89
„	7	97
„	12	105
„	14	112
„	17	114
„	21	132
„	25	130
„	31	131
November	2	131
„	11	154
„	23	136
„	30	136
1892, December	6	125
„	18	102
„	28	75
„	31	65
1893, January	7	58
„	14	61
„	21	63
„	28	66
February	4	55
„	11	56
„	18	50
„	25	46
March	4	50
„	11	51
„	18	50
„	25	56
April	1	45
„	8	44
„	15	42
„	22	44
„	29	54
May	6	46
„	13	46
„	20	40
„	27	33
June	3	22
„	10	18
„	17	14
„	24	11
July	1	4
„	8	4
„	15	3
„	22	2
„	29	2
August	5	2
„	12	2

Note.—The Hospital was closed on August 29th, 1893.

Explanation of Temporary Small-pox Hospital.

Scale approximately 90 ft. to 1 in.

a.—Disused broken window covered with tarpaulin, which so escaped notice for a considerable time.

Old palings shown in broken lines, new ones shown in dotted lines.

c, c, b′, c′.—Old palings irregularly 4′ to 4′ 6″ high, with wide gaps between and below the boards through which children easily crept (*see* photo. p., 68).

b, b′, b″.—New palings about 7′ or 8′ high; strong, but with cracks through which people could talk. *b, b′,* ordered to be erected September 18th; *b′, b″,* ordered to be erected September 30th, not completed till middle or end of November.

b″, c″.—Old palings through or over which access to the hospital could always be obtained through the alleyways *h h,* for the rope walk was open and the ditch shallow.

e, e.—Barricades across Dallam Lane, erected first week in November.

f.—Entrance to the Dallam Forge used by the workmen at the forge for six or seven weeks after the hospital was opened; or later.

g, g.—These, the residential buildings for the staff, were purchased October 25th, and completed during the second week in November: up to that time the staff went to and fro daily to Aikin Street Hospital.

Staff.

During the two weeks succeeding the opening of the new hospital on September 19th, the Medical Officer of Health, in addition to his charge at the old hospital, and his duties as Public Vaccinator, Public Analyst, and Medical Officer of Health, had also charge of the new hospital.

On September 24th his son, Dr. J. Guest Gornall, was appointed Assistant Medical Officer of Health, and took charge of the patients in the new buildings on October 4th.

Until November 9th this gentleman, the entire nursing staff, and other officers slept at the old hospital (Aikin Street) going backwards and forwards each day to the Temporary Hospital (Dallam Lane); mostly, I was informed, in a cab.

There was naturally some difficulty in obtaining a sufficient staff of nurses under the circumstances and the convalescent patients had to be engaged to assist. The work devolving on those employed must have been very considerable under any circumstances.

I made careful inquiry during my visits in January into the movements of the staff, but though reasonable precautions seem to have been taken, I was not convinced of the impossibility of infection by these means, even apart from the practice of going backwards and forwards just alluded to. The difficulties to cope with were very great.

SUB-SECTION *c*.—ADMINISTRATION.

Owing to the urgent circumstances which led to the institution of this temporary hospital, it is not at all surprising that there were many imperfections in the isolation of the patients. The cases were so numerous compared with the means of dealing with them, that it was only natural that the ignorance and foolhardiness of the inhabitants should, of necessity, remain unchecked.

But in view of the inquiry as to how far, and by what means, this hospital served as a centre for the spread of the disease, *and whether it occurred by aërial convection or by direct means*, it is only right to record the following circumstances and incidents.

1. There being no disinfector at the temporary hospital the small-pox patients' own clothes were sent from the temporary hospital to the disinfector at the old hospital (Aikin Street) and brought back to the New Hospital.

2. A separate small-pox ambulance was established in November; until then the one ambulance from Aikin Street was sent for all cases of both scarlatina and small-pox.

3. Case 145 (in hospital, October 7 to about November 30) stated, voluntarily, that there was an old disused window on the north side of the temporary hospital premises covered only by a piece of tarpaulin, which escaped detection, and through which the friends of patients used to communicate with the patients and bring them spirits.

4. A woman (J. B.), living in Owen Street, voluntarily informed me in March 1893, that she had "seen" during the epidemic, "a good many people get over " the palings (b'' c'' temporary hospital plan); and the " *workmen used to come out this way to get their beer.*" She also stated that "patients talked and shook hands " with their friends over the palings on east side up " till quite recently, and people used to get through " holes in the fence and visit their friends." There would be, she thought, 150 cases in hospital all this while.

5. Case 320, mentioned of her own accord that while she was in hospital (November 10 to November 30) " anybody could get over, and that the children did " get under and through the palings on the Winwick " Road side" (east).

6. Case 219 (eruption, October 23) states that he took the small-pox by talking over the Hope Hospital fence " with his friend, Case 114, just 14 days before the " eruption." (*See* Photo 3, opposite.)

7. P.C. 36 whom I found on patrol duty in Dallam Lane, on January 24th, 1893, replied to me, "Yes, we have " a good deal of difficulty to keep 'em (the visitors) off " the palings, especially during the dinner-hour." He referred to the palings on the east side of the hospital beside which the open space exists. (*See* Photo.)

8. Submitted herewith is a photograph (photo. 3) of the palings which I took in June 1892, and which shows that the same condition of matters still existed then. There were people on the fence at the moment of exposure. The picture is taken from, and shows part of, the open space on the east of the hospital, where the children may be seen playing and peeping through the palings. Over the hospital away to the westward are seen the chimneys of the Dallam and Bewsey forge. The old palings may still be seen on the left of photo., though at this time some new ones had been erected behind them.

9. It is but human nature for the children playing about the streets and spaces around the hospital to clamber on to and through the palings to satisfy their curiosity, and thus contract the disease (as in Cases 152, 563, and 607), or take the disease to their homes, like the children of Cases 193, 353, 354. The ambulance also excited the greatest interest, and the proceedings in and about the hospital generally. See other instances, p. 72.

DESCRIPTION OF PHOTOGRAPH 3. OPPOSITE p. 68.

Open space on east side of Temporary Small-pox Hospital which is the common place of resort for the inhabitants in the 189 neighbouring houses. The brick wall on *r* is the end of the hospital (opened September 19). The palings in the middle, through which the children and adults are peeping, and over which the patients are looking, were erected in the latter part of September. On the *h* are the old palings through and under which children and others could crawl (Hospital plan p. 67, *b*, *c*). Some new palings were erected behind them in November, but old palings like these existed always on the south side of the hospital (b'' c''). Beyond the Hospital are the chimneys of the Dallam and Bewsey Forge.

Photo 3, p. 68.

ROYAL COMMISSION ON VACCINATION.

DR SAVILL'S REPORT ON THE WARRINGTON SMALL POX EPIDEMIC 1892-3.

Section VII. Aërial spread of Small Pox.

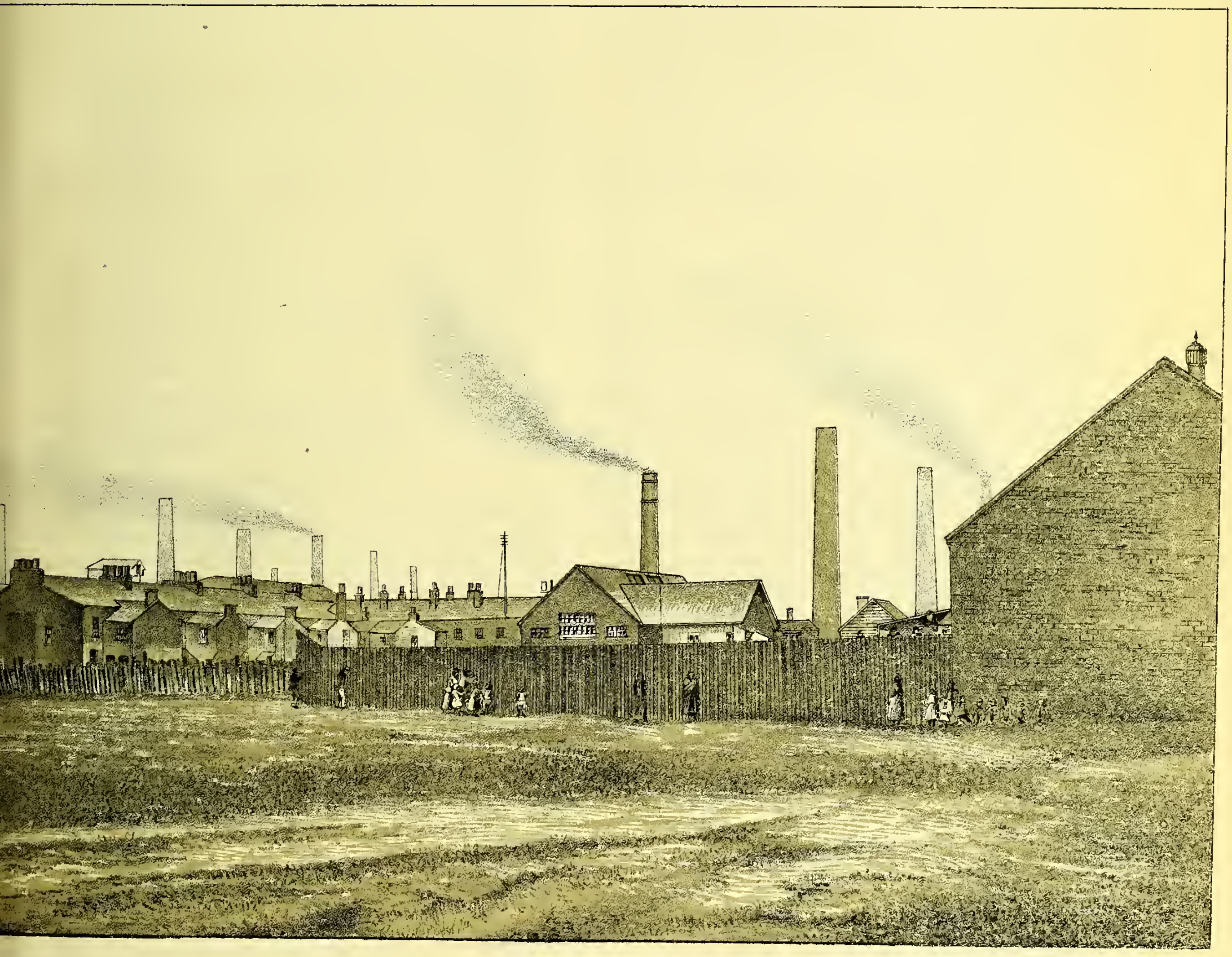


Photo 3. Open space on east side of Temporary Small Pox Hospital which is the common place of resort for the inhabitants in the 189 neighbouring houses. The brick wall on R. is the end of the Hospital (opened Sep. 19). The palings in the middle, through which the children and adults are peeping, and over which the patients are looking, were erected in the latter part of September. On the L. are the old palings through and under which children and others could crawl (Hospital Plan p. 67 b c). Some new palings were erected behind them in November, but old palings like these existed always on the south side of the hospital (b" c"). Beyond the hospital are the chimneys of the Dallam & Bewsey Forge.

SECTION VII.—SPREAD OF SMALL-POX BY AËRIAL CONVECTION, AROUND THE TEMPORARY HOSPITAL IN DALLAM LANE.

Sub-section *a*.—Preliminary Considerations.

How Small-pox may be spread, and limitation of this Inquiry.

There are three ways in which it is believed the infection of small-pox may be propagated—

1. *Immediate* spread from one patient to another, who usually develops the eruption 14 days after contact.
2. *Mediate* spread of infection by means of a third *person* who does not necessarily contract the disease himself—instances of which were mentioned in the spread within the workhouse (p. 13, *ante*),—or, by means of infection conveyed by some *inanimate object*, such as the mode of infection of Case *d*. (p. 8, *ante*) who was engaged in disinfecting the house of Case *a*.
3. *Convection by Aërial Currents.*—The poison of small-pox is believed in all cases to be conveyed through the air, and to find entrance to the respiratory passages, but in what follows *aërial convection will be taken to mean infection through the air at a distance of* 20 *yards and upwards*. It has seemed to me unnecessary, for practical purposes, to consider, on the present occasion, the dissemination of small-pox infection through the air within that distance (as mentioned on p. 3, *ante*). Material is not forthcoming for the narrower investigation, but it will be profitable to inquire into the truth of the allegation that the infection of small-pox was, in the Warrington Epidemic 1892, carried beyond that distance. Aërial diffusion and aërial convection are held to be synonymous.

The first is said to be the most usual method. The first two of these methods are admitted, but the third is much debated by equally high authorities on either side.

Conditions necessary to prove Aërial Convection.

Four of the means for establishing the truth of the aërial convection theory would seem to be by showing—

1. That the immediate and the mediate methods of infection were neither of them in operation in any given case or cases which form the basis of observation. In other words, that the mediate and immediate methods of infection were insufficient to account for all the cases in a given area.
2. That the proportion of infected houses or persons (whose infection is not accounted for by mediate or direct means) varies with the distance from the supposed centre. In actual practice, in an epidemic of any size, this is an almost impossible condition.
3. That the proportion of infected houses (where the infection is unaccounted for by direct or mediate means) in a given district around the supposed centre varies with the direction and the strength of the winds.*
4. That the proportion of persons so attacked varies with the number of cases collected in the supposed centre, and, as some say, with the stage of the disease which the cases have reached: in other words, the period of a "rising epidemic"—in the present instance October to December 1892.

Proportions 2 and 4 might also exist where the hospital is itself, as in the present instance, an unsuspected source of *direct* or *mediate* infection to the neighbourhood. The practical difficulties in carrying on an inquiry into this question are indeed very great.

Conditions necessary for an Inquiry as to Aërial Spread.

The difficulty, almost the impossibility, of *excluding the immediate and mediate sources of infection*, is generally the first bar to the proper investigation of the subject of aërial spread.

My experience from day to day in Warrington during the past year (1892-93) has impressed upon me the imperative necessity of five conditions for carrying an inquiry on this point to a favourable issue.

1. A certain "detective acumen" in the observer, to enable him to seize and follow clues as to infection.
2. Unlimited patience, perseverance, and time at his disposal.
3. A thorough knowledge of the habits and mode of life of the people, and of the locality.
4. A certain amount of intelligent assistance on their part, and especially their memory for transactions and occurrences on certain dates.
5. Not too long a period of time to elapse between the outbreak in their house, and the date of the inquiry. In the present investigation, all but four of the cases arose between July 26th, 1892, and May 10th, 1893, and the inquiries into them were made between December 1st, 1892, and July 25th, 1893.

These five conditions are, I believe, necessary to trace direct or mediate sources of infection. If one or other of them be wanting the inquiry may, and does, result in failure to find the true direct or mediate source of infection, and the observer is thus led to infer that the disease was contracted by aërial currents, or in some mysterious or inexplicable manner.

But, even if these exacting conditions be fulfilled, there are still many sources of error, which in actual practice cannot be eliminated. For instance, the interval between infection and the eruption of small-pox, though usually, is not necessarily limited to 14 days. Instances, where the source of infection was known, have come under my notice in which the interval was as short as 12, and others as long as 17 days.* Is it ever possible to ascertain sufficiently detailed particulars of the person's life during five or more days, and of all the people with whom he has come in contact, to be able absolutely to exclude direct or mediate infection? Small-pox is a disorder having a very high infectivity. The exposure may be very brief, and the distance not very close, if the person is what is known as "susceptible" to take the disease. Instances of this have been mentioned in these pages (*vide* p. 3, &c.).

Finally, before presenting such facts as have been collected, permit me to mention two points:—

First—The question whether small-pox will spread through the air to a distance, is, from a practical point of view not one of very prime importance, since, on account of the ignorance and foolishness of patients and their friends, and the inevitable human fallibility of members of the staff of a hospital, it is very difficult, at least it would seem so, to prevent a highly infectious disorder such as small-pox being spread around a hospital by these means. At any rate spread often does occur. In selecting, therefore, a site for the isolation of this disease it is well, on these grounds, to choose one at some distance from a densely-populated area.

Secondly.—When we possess a knowledge of the identity, habitat, and life history of the small-pox contagium, it will doubtless materially aid us in the solution of this vexed question. We should then, for example, be able to ascertain what effect the free exposure to currents of fresh air, which is one of the best known natural germicides, has upon this germ. Known instances of the lasting vitality of small-pox infection are rare, compared with other infectious fevers, from which it would appear that the virus of small-pox is comparatively short-lived. It would therefore be interesting to know whether currents of fresh air are capable of destroying this germ as they do other germs, or whether they are able to carry it to a distance unharmed.

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* Some maintain that it is a gentle wind, or a foggy stagnant atmosphere which favours the spread of small-pox contagion through the air (*e.g.*, Waterhouse, quoted by MacVail).

* See also Report of Clinical Society referred to on p. 3, *ante*, where a series of cases of single exposure to infection are collected. In the greater number of those cases the eruption appeared between 14th to 16th day after infection; the shortest case appeared on 12th day, the longest on 23rd day.

SUB-SECTION *b*.—POSITION OF THE TEMPORARY HOSPITAL.

The temporary, or as it was named the Hope Hospital, was situated on the eastern side of the northern extremity of Dallam Lane (*vide* Map I. at end). On the opposite (west) side of Dallam Lane are the Dallam and Bewsey Iron Works, and abutting on the hospital premises (south) are the backs of 13 houses in Owen Street, (*see* plan of hospital, p. 67, *ante*) only separated by a disused rope walk, a dry ditch, and a broken paling which was never mended.

On the eastern side of the hospital is a piece of waste ground (*see* Map I. and photograph p. 68) measuring about 140 yards square, where the children were always to be seen playing, and where the occupants of the neighbouring houses in Owen Street, Stamford Street, Winwick Road, and other streets, congregated. The backs of the houses in these streets opened on to this space which seemed to be the resort not only for these but for all the houses of the neighbourhood. Rounders, hockey, and football were ordinarily played here (*see* photograph).

There are, as may be seen from the annexed diagram, 13 houses within 100 yards of the centre of the hospital wards, and a total of 1.075 houses within 500 yards containing an aggregate of some 6,000 persons. Out of these 1,075 houses, 112 (or 10·4 per cent.) became infected during October, November, and December.

It will be remembered that two or three weeks after the removal of the small-pox patients from the Old Fever Hospital to the temporary hospital on September 19th, the heart of the epidemic changed its position from the houses adjacent to the old hospital to the houses in the neighbourhood of the temporary hospital. This was not unnaturally attributed to an aërial diffusion of the infection. We will now look a little more closely into the facts.

SUB-SECTION *c*.—THE PROPORTION OF INFECTED HOUSES AT DIFFERENT DISTANCES FROM THE HOSPITAL.

Submitted herewith, but too large for republication, is a large scale Ordnance map (10 ft. to the mile) made in 1888 and corrected by me to date (1893), on which the infected houses are marked by spots.

The annexed diagram shows the number of houses in each circular area from 1 to 500 yards around the hospital, worked out from the large scale Ordinance map, and also the proportion of these which became infected in the three months October to December when the hospital contained most cases. *In nearly every instance diligent search revealed a direct or mediate source of infection:* in the remainder I had reason to believe that it was want of time or other facilities which prevented the clue being traced.

The proportions in the different zones as a whole work out pretty regularly inversely to distance from centre. But this is by no means so as regards the different quadrants. The south-east quadrant, for instance, the most populous one, shows from centre to circumference 60 per cent., 14 per cent., 16 per cent., 18 per cent., and 7 per cent. Full particulars are given in the diagram and table below it.

But if the hospital were a means of the *direct* spread of small-pox (without any aërial diffusion), and grounds have been given for believing that it was so (p. 68), it would be equally probable that the persons whose homes were situated nearer to the hospital would be more infected than those living at a distance. And those who reside near the open space beside the hospital would be more likely to frequent it than others living at a distance (photograph, p. 68).

Reduced maps spotted* with the position of houses which became infected in different months respectively, are also submitted (*at end of Report*). Their accuracy is necessarily not so minute as the large scale map on which the above results are based. It will be noticed that the largest number in this area occurred in November, and that the major portion of these are *congregated around the open space* (*d*) beside the hospital.

The *date of appearance of the eruption* has been taken as the guide here, for it is the most reliable and accurate date obtainable. If, therefore, it be desired to ascertain when infection was first brought into the houses marked, 14 days before the beginning and end of each month will give approximately (since the period of incubation of small-pox is not invariable) the periods when those houses had infection conveyed into them.

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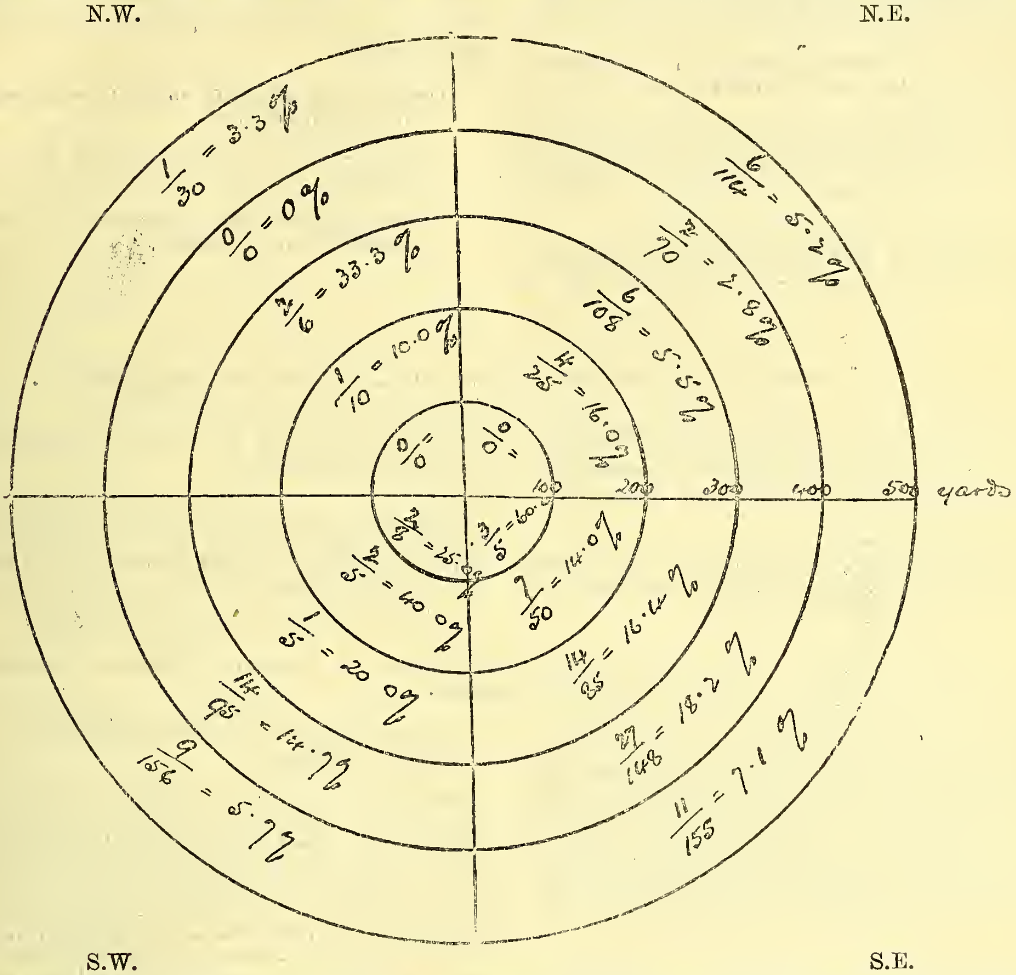
* By Mr. Ed. Gibbon, who possesses very complete knowledge of the locality, under my supervision.

Diagram showing the Per-centage of Infected Houses around the Temporary Hospital (Dallam Lane) at a time when the Hospital contained the largest number of cases (October 1st to December 31st, 1892). The figures here given are worked out from a large scale map, (10 feet to the mile), and therefore represent a high degree of precision. Houses through which the circles passed were counted in the zone in which their major portions lay.



Note.—*Infected* houses form the numerator, and the *total* number of houses form the denominator of each fraction.

TABLE XLVI.

Summary of Dallam Lane Chart.

Zones.	No. of Infected Houses.	Total No. of Houses in Area.	Per-centage of Infected Houses.
0—100 yards circle -	5	13	38·4
100—200 „ -	14	90	15·5
200—300 „ -	23	204	11·2
300—400 „ -	43	313	13·7
400—500 „ -	27	455	5·9
	112	1,075	Per-centage of whole area 10·4

Quadrants.	No. of Infected Houses.	Total No. of Houses in Area.	Per-centage of Infected Houses.
N.W. - - - -	4	46	8·7
N.E. - - - -	18	317	5·6
S.W. - - - -	28	269	10·4
S.E. - - - -	62	443	14·0
	112	1,075	

Sub-section *d.*—Relation between Position of Infected Houses and the Direction and Force of the Wind.

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The prevailing direction and force of the wind on different days are given in Part IV. of this report (p. 95) in an exhaustive table supplied to me by the courtesy of the Medical Officer of Health. The readings were taken at the Aikin Street Hospital, but the distance between the two hospitals is only 1,000 yards.

The prevailing winds during the months of October, November, and December were the S.W., 32 days, and the S.E., 22 days, *i.e.*, 54 days out of a possible 92. There were also—

8	days	northerly	winds.
20	„	N.E.	„
1	„	E.	„
1	„	S.	„
1	„	W.	„
7	„	N.W.	„

If, therefore, other causes of infection were excluded the N.E. quadrant should have been most infected, N.W. next, S.W. next, and S.E. least. But the percentage of infected houses shows the exact converse of this, viz., S.E. quadrant 14 per cent., S.W. 10 per cent., N.W. 9 per cent., and N.E. 6 per cent.

The number of infected houses is not, therefore, proportionate to the direction of the wind, during the three given months.

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During October the records, so clearly preserved by the Medical Officer of Health, show that the winds in October were only moderate, the prevailing winds being S.W. 10 days, N.E. 9 days, and N. 8 days.

In November the winds were very light, the prevailing directions being S.W. 16 days, and S.E. 12 days.

In December the winds were only moderate, the prevailing directions being S.E. 10 days, N.E. 10 days, S.W. 6 days.

The only days during these three months with high winds were—

> October 19th, when 400 miles N. wind was registered during the day.
>
> December 6th, when 655 miles S.W. wind was registered during the day, and
>
> December 12th, when 355 miles W. wind was registered during the day.

Sub-section *e*.—Proportion of Infections relative to the Number of Cases in Hospital.

If the infection from a hospital or centre take place by aërial diffusion, one would expect to find that the number of infections bear a fairly direct proportion to the number of patients in hospital who presented the disease in an active state.

From the Table XLV., p. 67, *ante*, it will be seen that the largest number of patients in the temporary hospital were during October, November, and December. The average of these three months being 110, 139, and 92 respectively.

That is why these three months were taken in estimating the relative number of infections in the different zones. These three months represent all the conditions of a "rising epidemic."

Sub-section *f*.—Sources of *Direct* Spread in the Area around the Temporary Hospital, exclusive of the Factories.

These sources may be grouped under six headings:—

1. In investigating the question of aërial spread the very first thing to do is to ascertain whether *the hospital*, its patients and officers, are cut off from any direct communication with the outer world, and the outer world with them. Various incidents and circumstances have been mentioned in the preceding section (p. 68), which show beyond doubt that this was not the case.

2. The *open space* beside the hospital (hospital plan, p. 67, and photograph, p. 68) was a very potent factor in the direct spread (both immediate and through a third person). This space was the place of resort for all the people living round it, and also those coming from a distance who wished to communicate with their relatives and friends in the hospital. Instances of persons contracting disease in this way have been mentioned. Two other instances may also be given:—

The mother of Case 563, æt. 13 (eruption March 7th), living in Tanner's Lane, 600 yards from the hospital, stated "he was always near the palings on the open "space near the hospital—no keeping him away at "that time."

Case 607, æt. 9 (eruption April 6th), lived in Pierpoint Street rather less than 500 yards from the hospital, but separated from it by the railway line, and therefore giving a greater presumption of aërial spread. His mother stated that "two weeks before the eruption he "went up to the hospital with little M——, whose "father died in hospital, and peeped under the "palings."

The mother of Case 152 (æt. 7, eruption October 6th), living in Owen Street (plan, p. 67), affirmed: "He and "plenty other boys got on palings, which were very "old, and we leathered him off. Other mothers also "strapped their boys for the same. There were also "holes in palings on other side of rope-walk *through* "*which the children went* to watch the cases unloaded "from the vans," (photograph, p. 68, shows some of these palings on the left).

The children of all the houses situated anywhere near were in the habit of playing on this open space, and like the children of Cases 193, 353, and 354, took the infection home to their relatives. In the photograph of this open space submitted (p. 68), some children may be seen playing here.

3. Cases of *delayed isolation* within the area of supposed aërial diffusion.

Case 354, living in Owen Street, beside the hospital developed the eruption about October 12. He was never isolated at all. His wife who lived at home with him, but also went daily, as waitress, to the "F——s' Arms" in Dallam Lane, hard by, the chief place of resort of the Dallam forgemen. She waited on the visitors to this inn and looked after her unisolated husband during four weeks up to November 9th, when she herself began to sicken of the malady, having in the meantime conveyed the disease to two of the inmates at the inn (*vide infra*), and to an indefinite number of the Dallam forgemen, who were supposed also to be under the influence of aërial diffusion from their proximity to the hospital.

It was during the three weeks ending November 19th that no fewer than 43 of the Dallam forgemen developed the eruption (*vide* Table, p. 75).

Annie W——(Case 43), living at 20, Pierpoint Street, which is within the 500 radius, the other side of the railway, developed the eruption on September 8th, and remained at home until 19th. Her brother worked as a labourer all over the Dallam and Bewsey forge the while. Case 138 came a good deal in contact with this man and developed the eruption on October 4th.

Annie C——(Case 49), eruption September 9th, lived in the same street, and was at home for 10 days with the eruption out.

This highly-infected street, Pierpoint Street, where so many of the Dallam and Bewsey forgemen lived, being separated by the railway from the hospital, though within 500 yards distance of it, might be regarded as a good illustration of aërial conveyance. But, bearing in mind the gregarious habits of the people, it is not surprising that the disease should spread in succession from these and other unisolated cases in the street.

Table XLVII. gives the reference numbers of the cases, and the days spent at home with the eruption out, of persons who developed the rash between October 1st and November 12th inclusive, in the area comprised within 500 yards radius of the hospital and in the 500–1,000 zone. There were 65 in the former and 28 in the latter, making a total of 93 cases of delayed isolation within 1,000 yards of the hospital. The investigation was too laborious to pursue up to the end of December, but this is quite sufficient to show the extensive possibilities of direct infection in this area without the necessity of assuming aërial diffusion from the hospital.

TABLE XLVII.

Showing Cases left at Home for three or more Days with the Eruption out between October 1st and November 12th inclusive, within the 1,000 yards Area of the New or Temporary Hospital.

—	0 to 500 yards Area.	500 to 1,000 yards Area.
October 1 -	123 (3 days) - - -	122 (3 days).
„ 2 -	126 (3 days) - - -	136 (5 days).
„ 3 -	139 (4 days) - - -	132 (5 days).
„ 4 -	- - - - -	134 (3 days).
„ 5 -	145 (3 days) - - -	
„ 6 -	149 (4 days) ; 151 (4 days) ; 152 (4 days.	
„ 7 -	- - - - -	156 (4 days) ; 169 (15 days).
„ 8 -	157 (3 days) - - -	
„ 9 -		
„ 10 -		
„ 11 -		
„ 12 -	180 (5 days) - - -	
„ 13 -		
„ 14 -	188 (5 days) - - -	182 (4 days),
„ 15 -	183 (3 days) ; 179 (4 days) ; 212 (9 days).	
„ 16 -	186 (never) ; 190 (never) ; 193 (4 days) ; 194 (4 days).	197 (4 days) ; 203 (6 days)
„ 17 -		
„ 18 -		
„ 19 -	204 (3 days) - - -	
„ 20 -	209 (3 days) - - -	
„ 21 -		
„ 22 -		
„ 23 -	214 (4 days) - - -	
„ 24 -	228 (3 days) ; 229 (4 days) -	
„ 25 -	233 (4 days) - - -	
„ 26 -	234 (3 days) - - -	
„ 27 -	246 (5 days) - - -	
„ 28 -	243 (4 days) - - -	
„ 29 -		
„ 30 -	249 (3 days) - - -	
„ 31 -	253 (3 days) - - -	
	Total - 28 cases.	Total - 9 cases.
November 1	297 (8 days) - - -	254 (3 days) ; 256 (3 days).
„ 2	258 (3 days) ; 259 (3 days) ; 274 (6 days).	
„ 3	267 (3 days) ; 369 (never) -	281 (6 days).
„ 4	272 (4 days) - - -	
„ 5	278 (3 days) ; 279 (3 days) ; 294 (4 days).	265 (never).
„ 6	296 (4 days) - - -	284 (3 days) ; 285 (3 days).
„ 7	300 (3 days) ; 303 (3 days) ; 311 (26 days) ; 312 (8 days) ; 314 (8 days).	299 (3 days) ; 304 (3 days).
„ 8	313 (8 days) ; 317 (never) ; 320 (3 days) ; 321 (4 days) ; 330 (8 days) ; 347 (never).	342 (never).
„ 9	310 (7 days) ; 315 (8 days) ; 329 (never) ; 350 (5 days).	307 (never) ; 334 (9 days).
„ 10	327 (8 days) ; 353 (6 days) ; 363 (6 days) ; 365 (6 days).	325 (never) ; 343 (5 days).
„ 11	341 (5 days) ; 352 (5 days) ; 360 (4 days).	337 (never) ; 345 (20 days) ; 358 (7 days) ; 385 (11 days).
„ 12	328 (never) ; 355 (5 days) ; 374 (6 days) ; 405 (33 days).	351 (never) ; 359 (never).
	Total - - 37	Total - - 19
	Grand total - 65	Grand total - 28

Note.—The word " (never) " in this table should read (never removed from home at all).

4. *Public-houses and Shops* where cases occurred within the area.

There are several much frequented inns and beer shops in this area. As an instance the following may be mentioned :—

There is abundant evidence to show that the "F—— Arms" in Dallam Lane, 150 yards from the Temporary Hospital, is a popular place of resort, and especially for the Dallam Lane forgemen, as the forge is on the opposite side of the street. Among the inmates of this inn two cases (mother and son, 353 and 454) arose in succession, infected from the waitress just now mentioned. One of these two cases was at home six days with the eruption out (November 10–15), and formed a source for a series of infections.

There are also many little *general stores and shops* within the area. The following are some instances where cases arose, and where the isolation was delayed (Table XLVIII.) :— Shops.

TABLE XLVIII.

Case No.	Day of Rash.	Day of Removal.	Kind of Shop.	Distance from New Hospital.
145 Other cases later.	Oct. 5	Oct. 7	Butcher	450 yards.
151	Oct. 6	Oct. 9	Grocer	475 „
180	Oct. 12	Oct. 16 (No disinfection).	General Store	200 „
365	Nov. 10	Nov. 15		
203	Oct. 16	Oct. 21	Greengrocer	550 „
193	Oct. 16	Oct. 19	General Store.	125 „

5. The *gregarious habits* of the inhabitants.

The families of the working classes of Warrington seemed very much to live in each other's houses in common. The children when not at school, or at play in the streets or open spaces, have the run of all the houses in the street. The women when not at house-work go in and out for a gossip. The men, if not at work, spend most of their time in the public-houses.

Case 420 attributed her infection to the fact that the children of a neighbour, who developed small-pox 13 days previously, almost lived in her house.

I found by personal experience that the passage of a wheeled vehicle along some of the streets was quite an event in the lives of some of these poor children. I often had a crowd of 40 or 50 close around me, and the removal of a patient in an ambulance was an occasion which seemed to demand much conflict as to who should get closest to it, and finally as to who should have the privilege of riding off behind it.

6. *Unsuspected sources of direct infection from a distance.*

Such cases often require much patient investigation, and many a clue has to be followed to a disappointing issue. Two examples of cases arising in this area in this way may be mentioned.

Case 246, residing 325 yards from the hospital, developed the rash on October 27th. He walked daily right across the area, through Owen Street, and past the hospital to his work situated only 250 yards the other side of the hospital. But the more obvious source of his infection was his sweetheart, who worked at a fustian cutter's in Wakefield Street outside the 1,000 yards area.

Case 179, residing 330 yards from the hospital, developed the eruption on October 15. He walked daily across the open space beside the hospital and down Dallam Lane to the brewery, 350 yards south of the hospital. But the more obvious source of his infection was also his sweetheart, a fustian cutter, who lived quite outside the area.

Summary and Conclusion.

Reference has been made in this sub-section to the many possible sources of *direct* infection which existed in the area around the temporary hospital, and illustrations given of how the open space beside the hospital, the unisolated cases at home (especially such as lived at shops), the public-houses, and the gregarious habits of the inhabitants may propagate the disease. Reference has also been made to the difficulty which sometimes presents itself in the residual cases of tracing the true source of infection, even apart from markets, theatres, and other places of amusement, where people congregate together. A large proportion of the cases in this area could be, and were, traced without much difficulty to a direct source, and I was led to believe that every one of them could have been traced without the necessary intervention of the hypothesis of spread by aërial currents, had the time at my disposal been unlimited.

The spread among the working people at the Factories in this area will next be considered.

SUB-SECTION *g*.—INCIDENCE of SMALL-POX amongst the hands at the FACTORIES around the HOSPITAL, and especially at the DALLAM and BEWSEY FORGE.

In order, finally, to ascertain whether aërial diffusion played an appreciable part in the propagation of small-pox around the temporary hospital in the Warrington epidemic, let us examine minutely the incidence of the disease among the workpeople employed at the various factories within 500 yards of the hospital.

The persons employed in these works spent their days, some of them, like the iron workers and fustian cutters, in a dusty atmosphere, others, like some of the brewers, in steam. All of them spent the working portion of their lives—that portion, be it remembered, in which respiration is far more active than at other times, when at rest or during sleep—under conditions eminently favourable to aërial infection, if such existed.*

The hands were for the most part adults, healthy, and vaccinated. As individuals they were strictly comparable; they differed only in their work, the position of that work in relation to the hospital, and the exposure to infection at home or elsewhere.

There were ten works or factories of any size within 500 yards of the Dallam Lane (Temporary) Hospital. Table XLIX. gives a summary of the particulars concerning them.

1. It will be noticed that there seems to be, in general terms, a tendency for those works nearest to be most affected; at any rate, those within the 250 to 320 yards zone are more affected than those in the 400 to 500 yards zone. On the other hand, an inspection of this table shows that, although the Dallam and Bewsey Forge and the Dallam Lane Brewery are both within the 300 yards radius of the hospital, and both abut on Dallam Lane; nevertheless, the first had a case incidence of 3·5 per cent. and the latter only 1·1 per cent. This important coincidence will be referred to again directly (p. 77).

2. It will be seen, also, that the direction in reference to the hospital varies considerably, most quarters being represented. The prevailing winds were S.W. 32 days, and S.E. 22 days (*see* page 71, *ante*). Nevertheless, it was not the factories on the N.E. and N.W. of the hospital which were most affected.

3. These particulars refer to the three months October to December 1892 when the largest number of cases were in hospital, and the epidemic was on the rise, therefore this source of infection was at this time at its maximum.

The occurrence of small-pox among the different workpeople at work in the area round the hospital does not, therefore, on the surface, satisfy three of the four conditions mentioned on page 69, *ante*, as necessary to establish the theory of aërial spread.

It will, moreover, be remembered that if the hospital itself be a source of *direct* infection it is only natural that those nearest should be most affected. We shall see that it was a direct source of infection, and that many other sources of direct infection were in operation to spread the disease among these workmen (p. 76).

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* It has been calculated by Dr. Edward Smith that a man walking four miles an hour inspires five times as much air as a man in the recumbent position (quoted in Parke's Hygiene, 8th edition, p. 3.

TABLE XLIX.

PARTICULARS of the position of the FACTORIES in the 500 yards Area around the temporary SMALL-POX HOSPITAL in Dallam Lane and the Incidence of Small-pox amongst the Workpeople, during the Months of October, November, and December 1892, arranged in Order of Distance from the Hospital.

Note.—These figures do not necessarily correspond with those given in Table LV., which refer to a different period of time.

Name of Works.	Kind of Work done.	Distance of centre of Works from centre of Hospital, and Direction.	No. of Hands Employed.*	No. of Hands who developed Rash from 1st Oct. to 31 Dec. 1892.†	Percentage Attack-rate.	Remarks.
London and North-Western Railway Engine Sheds.	Manufacturer of locomotives.	250 yards N.W.	253	7, $15\frac{\text{VII.}}{7}$ $546\frac{\text{IX}}{25}$, $248\frac{\text{II.}}{18}$, $246\frac{\text{XI.}}{3}$, $353\frac{\text{XII}}{1}$, $458\frac{\text{VIII.}}{14}$, $347\frac{\text{XII.}}{14}$	2·7	
Dallam and Bewsey Forge	Iron manufacture	250 „ S.W.	2,075	69, *see* Table LI.	3·3	
Dallam Wire Works, Smith and Son (adjacent to and practically part of the foregoing).	Wire drawing	275 „ S.	120	10	8·3	
Dallam Lane Brewery, P. Walker and Son.	Brewing, &c.	300 „ S.S.E.	364	4, $303\frac{\text{X.}}{9}$, $296\frac{\text{XI.}}{22}$, $179\frac{\text{X.}}{5}$, $311\frac{\text{XII.}}{16}$	1·1	
Longford Wire Co.	Wire drawing and annealing.	320 „ E.N.E.	149	3, $187\frac{\text{XI.}}{8}$, $462\frac{\text{XI.}}{13}$, $214\frac{\text{X.}}{4}$.	2·0	
Chandos Foundry	Iron making	400 „ S.S.E.	25	0	0	
Wilkinson's	Velvet cutting	435 „ E.N.E.	90	0	0	
Winwick Road Tannery	Sizing	450 „ S.S.E.	55	1, $352\frac{\text{XII.}}{21}$.	1·8	
Orford Lane Glass Works, Ed. Bolton and Sons.	Sorting glassware	480 „ S.E.	92	1, $114\frac{\text{II.}}{9}$.	1·0	
Warrington Wire Rope Co.	Wire rope making	500 „ S.S.W.	86	0		

Kind of Work.

The nature of their work may be regarded as an important factor in the aërial propagation of the malady amongst them, but it is an extremely difficult one to gauge. Free movement of air and ventilation is necessary to them all, and by the courtesy of the managers I had the opportunity of visiting these works. The iron and wire-work is a dirty, dusty, and generally a hot trade. Brewing and tanning are cleaner, but the former is attended by steam. Velvet-cutting is a very dry, dusty occupation, carried on almost entirely by girls.

There seemed in the Warrington epidemic to be no workers amongst whom small-pox spread with such rapidity as amongst the velvet—or, as they are called, the fustian-cutters, and if infection was being carried for 320 and 435 yards, these women and girls should at this time certainly have been largely affected; especially in that shop lying E.N.E. of the hospital where 90 girls were working daily, for there were 32 days of prevailing S.W. wind. In the early part of 1893 small-pox was introduced amongst Wilkinson's hands by direct infection and spread with great rapidity, but *not a single case arose amongst them in the last three months of* 1892, when the hospital was full to overflowing, and the prevailing wind blew their way.

Attack-rate.

It is unnecessary to give all the data collected concerning all the factories within the 1,000 yards radius with the same detail as the Dallam and Bewsey Forge. Similar conditions applied to them as to the latter, and in all there was a remarkable absence of unexplained infections. This is particularly so as regards the Dallam Lane Wire Works which had so high an attack-rate, p. 74). These works are practically part of the Dallam and Bewsey Forge. Their entrance is exactly opposite the F——'s Arms, where most of the men contracted the disease; this fact, and the other causes of direct infection, are quite sufficient to account, by direct infection, for the number of hands attacked.

SMALL-POX AT THE DALLAM AND BEWSEY FORGE.

Its Position.

We will now examine the incidence of the disease at the Dallam and Bewsey Forge, close beside the temporary hospital, which employed the largest number of workpeople (2,075), covered the largest area, and also had a high attack rate (3·4).

These are large iron works covering a triangular area nearly ¾ square mile in extent, lying along the western side of Dallam Lane, which alone separates them from the hospital at its northern end (*vide* Map I.). There are some railway tracks beside the lane, but they are quite flush and do not form any barrier, and several entrances exist down the lane.

Originally these works belonged to two firms, the northern half, known as the Dallam Forge, and the southern half, the Bewsey Forge. Now they are completely amalgamated. The apex of the triangle is to the north, opposite the entrance to the hospital, where there is also an open, gateless entrance to the forge for the Dallam men. The southern end or base is just within the 500 yards radius. The centre point lies 250 yards south-west of the hospital.

TABLE XXIV.

Showing Number of PERSONS working at the DALLAM and BEWSEY FORGE who developed the SMALL-POX RASH in each Week throughout the Epidemic.

Date.	No.	——
1892.		
Week ending—		
August 27 - -	2	
September 3 -	2	
„ 10 -	0	
„ 17 -	0	
„ 24 -	1	
October 1 -	1	
„ 8 -	3	
„ 15 -	4	
„ 22 -	4	
„ 29 -	4	During October, total 16 -
November 5 -	3	
„ 12 -	36	
„ 19 -	4	
„ 26 -	5	During November, total 48 -
December 3 -	1	
„ 10 -	1	
„ 17 -	0	
„ 24 -	1	
„ 31 -	2	During December, total 5 - -
1893.		
January 7 -	1	
„ 14 -	0	
„ 21 -	0	
„ 28 -	1	
February 4 -	0	
„ 11 -	0	
„ 18 -	0	
„ 25 -	0	
March 4 - -	0	
„ 11 - -	0	
„ 18 - -	1	
„ 15 - -	1	
April 1 - -	1	
„ 8 - -	1	
„ 15 - -	2	
„ 22 - -	0	
„ 29 - -	1	
None after this date.	—	
Total	83	

Spread amongst the Employés.

These workpeople were very early involved in the epidemic (p. 14), and also very extensively.

Table XXIV., here reproduced from p. 44, gives the weekly numbers of those who were attacked with small-pox. It will be seen that—

During October, 16 persons developed the eruption.
„ November, 48 „ „ „
„ December, 5 „ „ „

The heavy incidence (36 cases) during the week ending November 12th is a point worthy of particular notice.

The chief cause of the sudden outburst will be referred to on p. 76, namely, the waitress at the F——'s Arms. The probable reason of the succeeding decline of cases among these men is referred to on p. 44. The position of the department where each of these 36 cases worked when they contracted the disease is given below.

POSITION of the FORGE-MEN who developed the RASH during the week ending November 12th.

4 out of the 82 men employed at the 11″ bar mill (10).*

1 out of the 84 men employed at the warehouse (13).

15 „ 349 „ „ 7 and 8 inch bar mills (12).

2 out of the 178 men employed at the boiler and bridge yard (9).

6 out of the 149 men employed at the foundry and pattern shop (11).

3 out of the 329 men employed at the plate-mill (8).

1 „ 109 „ „ scrapping forge (2).

1 out of the 52 men employed at the wire-rod mill (1).

3 men worked all over the forge.

In Table LI., at the end of this section, are given particulars of all cases among the Dallam and Bewsey workmen from the point of view now under consideration, together with remarks upon the source of infection of those during September and October.

Conditions necessary to prove Aërial Convection.

Next, let us see if the facts as regards the spread in the *different* departments comply with the conditions mentioned on p. 69.

1. The question of the *direction of the wind* has not much bearing, as all the departments are, generally speaking, in one direction from the hospital, they all lie within the S.W. quarter.

2. As regards the *numbers in hospital* we are taking the three months when the hospital was twice as full as at any other time.

3. As regards the *proportion* of those attacked, and whether it varies with the distance from the hospital,—Table L. (top of next page), gives the results of my inquiries. It will be seen from column 6 that there is some general varying of proportion with the distance from the hospital, and this fact therefore answers one of the preliminary tests.

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* The numbers following the mills are the reference numbers to their position on Map I. (at end).

TABLE L.

Showing Per-centages of People Attacked in the different Departments of the Dallam and Bewsey Forge.

1. Shed or Mill.	2. Reference No. on Map. I.	3. Distance of Centre of Mill from Hospital.	4.† Total No. of Hands employed.	5. No. of Cases.	6. Per-centages.
11″ and 14″ bar mills	10	150 yards	82	7	8·5
9 and 10″ bar mills	13	170 „	84	7	8·4
Dallam Forge and 7″ and 8″ mills.	12	200 „	319	22	6·3
Boiler and bridge yard	9	225 „	178	6	3·3
Foundry, joiners, and pattern shop.	11	250 „	149	8	5·3
Plate mill, smithy, fitting and wheel shop.	8	275 „	329	11	3·3
No. 3 forge	6	350 „	88	1	1·1
10″ and 11″ hoop mills, No. 3 sheet mills.	7	375 „	210	3	1·4
No. 2 forge	5	375 „	86	1	1·1
No. 1 forge	4	400 „	86	0	0
8″ and 9″ hoop mills, Nos. 1, 2, and 4 sheet mills.	3	440 „	274	5	1·8
Scrapping forge	2	450 „	109	4	3·6
Wire rod mill	1	475 „	52	3	5·7
Clerks and hands all over forge	—	—	104	5	4·9

Particulars supplied by the courtesy of the manager of the works Mr. Thos. Morris. Probably the hands working "all over forge" have been included among those of the several mills.

4. But before adopting the theory of the spread by aërial currents to account for the higher proportion nearer the hospital, let us see first, whether the *hospital itself formed a direct source of infection*, and secondly, whether there were *other sources of direct infection* to these men.

(1.) *Hospital a source of direct Infection to the forgemen.*

Facts have been revealed in the preceding pages which show that the hospital itself was undoubtedly capable of forming a centre of direct infection. Now this was especially so for the Dallam men, that is those men employed in the northern and nearer part of the great iron works, for there existed an entrance (marked *f* on Map I. and plan of hospital) through which it was the common practice for them to pass in and out to work. This gate was never during the whole of the epidemic completely shut, and it was not until the first week in November that the barricades (marked *e e* on Map I. and plan of hospital) were placed across Dallam Lane. But, even then, all this did was practically to convert the upper part of the iron works into continuity with the hospital curtilage.

It will be remembered that the heaviest incidence amongst the forgemen was during the second week of November.

Now, as we have seen, a number of the men from this forge were constantly in the hospital under treatment, and many instances came under my notice where *forgemen contracted the disease by communicating with their fellow workmen in hospital.* And again, the open space on the east of the hospital was another most vulnerable point, and several instances came to my knowledge where forgemen had apparently contracted small-pox by holding communication with their fellows on this side also.

It seemed to me that the circumstances just mentioned were quite sufficient to account, not only for the large number of men attacked in the Dallam Forge, but also that the larger number should be attacked in those departments nearest to the hospital.

(2.) *Other possibilities of direct Infection to the forgemen.*

As regards other possibilities of direct infection they were very numerous and may be divided into four groups:—

(1.) Previous cases in their own homes of which a large number came under notice.

(2.) Unisolated cases living near them at home whom they visited.

(3.) Unisolated cases in their fellow-workmen's homes or other means of mediate infection by a third person.

(4.) Visits to infected public-houses and shops.

In Table LI. some remarks are appended to each case as to the source of infection during September and October.

No doubt, after the arrangement of the gate (*f*) just alluded to, opposite the hospital, the most potent source of infection at the Dallam and Bewsey Forge was a public house to which the men largely resorted, situated on the opposite side of Dallam Lane, and known as the "F—— Arms." Here it was that the wife of an unrecognized and unisolated case waited upon them from the 12th October, when her husband developed the eruption, till the 11th November, when she herself developed the rash.* It was here, also, that two of the inmates contracted small-pox from the same source, and they also were unisolated for some days. And there were also, in this neighbourhood, a good many small beer shops and general shops where cases occurred, and some of them, as Case 376, were never removed.

The following are interesting, not only as instances of direct infection to the Dallam and Bewsey Forge men, but also as examples of the way in which small-pox may be spread:—

Martha E—— developed the rash on 17th August; remained at home one month. During all that time her father and one of her brothers worked in the puddling mill, and another brother worked as a labourer all over the forge. There was no disinfection after she was removed on 9th September, for two weeks.

A man H—— developed the rash on 16th September. and was never removed. His next-door neighbour, who came to see him frequently, worked in the 11 and 14 inch bar mills all the while, and finally took the disease.

A man S—— developed the rash on 7th October, and was unisolated till 21st October. A man named M——, living in the same house, worked from the 7th to the 15th October at the Foundry, when he finally developed the eruption himself.

A man T—— developed the rash on 8th November, and was not removed till 15th November. A man named B——, living in the same house, worked at the plate mill all the time.

Richard W—— developed the rash on 9th November, and was never removed; his daughter developed the rash on December 2nd, and was also never removed. Both of them were about the house all the time. Two sons worked in the smithy and in the office respectively, all the time, except during two weeks after the second case.

Walter R—— developed the rash on the 10th November, and was never isolated, but was about the house all the time. His father and brother worked about in different parts of the Bewsey Forge all the while.

A man R—— developed the rash on the 9th November; he was never isolated. His father and brother worked at the forge all the time, until the father developed the rash on the 29th November.

Charles S—— developed the rash on 30th October; he was both unisolated and unrecognised. His brother worked as a painter all over the forge all the time, until he and a sister developed the eruption on the 12th of November.

John H—— developed the rash on the 11th November and was never isolated. A man living in the same house worked as a labourer in different parts of the forge until the 22nd November, when he also took the disease.

Anne D—— developed the rash on the 8th September. Her stepfather worked "up and down" the Bewsey Forge until she was removed on the 19th of that month.

George H—— lived in Portland Street, which is within the 500 yards area. He worked at the Dallam Wire Mill, and developed the rash on the 21st October. Nevertheless, the real source of his infection was his brother, who developed the rash 15 days before, and whom he frequently visited at that time, although he lived at some little distance.

Herbert S—— developed the rash on October 13th. He worked at the puddling mill of the forge and lived in Erwood Street, also within the 500 yards area; but the real source of his infection was his wife, who nursed Case 122, 13 days previously, and who conveyed the infection home to him.

Thomas P—— (Case 63) developed the rash on 20th September. He was the fifth person to be attacked at the Dallam and Bewsey Forge, but the real source of his infection was his mother-in-law, Mrs. M——, who used to come in and out at the same time that she was nursing the C——s (Cases 57, 98, and 112).

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* It was during the week ending November 12th that 36 cases arose amongst the forgemen. (Table, p. 75 *ante.*)

Summary and Conclusion as regards Aërial Spread.

It has been mentioned that in the early part of the epidemic the cases arose chiefly beside the *Old* or *Borough* Hospital, and that after September 19th, when the cases were transferred and admitted to the Temporary or improvised Hospital, they arose chiefly beside the latter. But a closer inspection of the facts shows that the infected houses in both instances were grouped around centres, lying not within the respective Hospitals themselves, but in open spaces *situated in the neighbourhood of the Old and Temporary Hospitals* respectively (b, c, and d in Map I.). There is good evidence to show (1) that these spaces, where the children played, and the neighbours gossiped, were important factors in the propagation of the disease; (2) that the unisolated cases in the houses around these space swere potent sources of *direct* infection; (3) and that (as an inevitable consequence of the hasty action of the authorities when in presence of a panic) both of the hospitals were themselves sources of *direct* and *mediate* infection.

There are, however, two circumstances which seem to speak in favour of the possibility of spread by aërial currents, viz.:—

(1.) The high attack-rate at the Dallam and Bewsey Works, adjacent to the Temporary Hospital.

(2.) The per-centage of each department of those works varying in some degree with the distance from the hospital.

On the other hand, there are three important considerations which are against this view, viz.:—

(1.) That both of the facts just mentioned are otherwise explicable, the hospital having been a source of direct infection on both its E. and W. sides and through the gate of the works; and the facts are also largely explicable by the infection from the "F——— Arms," and many other direct sources which have been enumerated on p. 76.

(2.) The fact which seems to me to tell most against the aërial view was one similar to the exemption from unexplained sources of infection in the workhouse cases, adjacent to the *old* Fever Hospital, mentioned on p. 66.

Walker's Brewery, a large establishment employing 364 hands, is situated, like the Dallam and Bewsey Forge, within 300 yards radius of the *new* hospital. Yet, not only was the attack-rate in this brewery considerably smaller, but all the four cases which occurred there are perfectly well explained by direct infection. Thus, Case 179 developed the eruption on October 15th, having contracted the disease from "sweethearting at Platt's fustian cutting shop," from which shop eight cases were removed in succession about this time. Case 303 developed the rash on November 17th, having contracted the disease from an adjacent house which became infected 14 days before. Case 311 developed the rash on November 7th, having contracted the disease from his wife, who developed the eruption 14 days previously. Case 296 developed the rash on November 6th. This man (M——) was obliged to walk from his home to his work down Stamford Street beside the hospital, at that time not adequately shut off from the open space, which was a source of so many direct and mediate infections. It was some time before any more satisfactory evidence as to this man's infection appeared. At length I ascertained that he spent the whole of one Friday evening at a beer-house, sitting close beside a man named Thos. D——, whose wife had developed the eruption the day before, and had only just been removed to the small-pox hospital that day (Oct. 21). Thirteen days later M—— sickened, and on Sunday morning, November 6, developed the eruption, 15 days after the incident.

(3.) Again, why were the 90 fustian-cutters at Wilkinson's, who were only 135 yards further away in a different direction, and the 25 forgemen at the Chandos Foundry, who were only 100 yards further away in the same direction as the Brewery, *wholly exempt* from small-pox during these three months, if aërial convection, was in operation? Or again, why were the Warrington Wire Rope Works exempt if small-pox infection can be carried to such a distance? The facts relating to the other works are similar to those concerning the Brewery, and, so as not to overburden this Report with detail, only those referring to the brewers are reproduced.

Perhaps it may still be asked why was the attack-rate in this Brewery, compared with that in the Forge so small? The brewers were not re-vaccinated till November 17th and 24th (when 337 were done), and up to that time they were exposed to all the influences of a rising epidemic, the hospital (opened September 19) was full, and the centre of the brewery was practically as close as the centre of the forge; and finally, if the aërial diffusion of small-pox had been in operation, the brewers ought to have been more infected with the small-pox, for they spent their days, when respiration is far the most active, at near distance from the hospital; and many of them walked to and from work across the open space beside the hospital. Every possible source of information was exhausted to elucidate the exemption of the brewers, fustian-cutters, the Chandos Iron Workers, and other workers from unexplained infections, and the only possible explanation was that the aërial convection of small-pox was not in operation. The real reason why so few of the brewers were attacked was because they were not exposed to such potent sources of *direct* infection as the forgemen. The entrance to the brewery was not, like the northern entrance to the forge, in direct continuity with the entrance of the temporary hospital (p. 76); the brewers had not, like the forgemen, unisolated cases of small-pox, or relatives of small-pox cases wandering about their midst (pp. 9, 14, and 76); nor did they communicate with their fellow workmen in hospital (p, 76); and finally, having an ample supply of beer they had no occasion to visit the "F——s Arms" and other places (p. 76). The absence of these and other sources of direct infection sufficiently explains the comparatively low attack-rate among the brewers. And, as we have seen, every single case was traceable to direct infection.

Conclusion.

Finally, as regards the whole subject of the conveyance of small-pox to a distance through the air, it is of course conceivable that a person exposed to a direct source, and to a mediate source, and also to an aërial current of small-pox infection, may have contracted the disease from any one of these sources, albeit exposed to all three. In that case to establish the possibility of a direct source does not absolutely exclude the others.

Nevertheless, speaking from my own experience at Warrington, in those cases, and they formed the majority, where there was time to thoroughly follow up the clues as to infection, a direct source, or else a mediate source of infection invariably became apparent, without recourse to the hypothesis of aërial convection.

The disease always seemed by me to spread directly along the lines of human contact.—which are doubtless very much controlled by the position of a person's habitation. For this reason, therefore, it is not surprising to find that the cases should appear, when marked on the maps, in localised groups.

The exemption of two such important communities as the inmates of the Workhouse and the workers at the Brewery from any cases arising within them, which could not more reasonably be explained by direct infection, seems to me to be against the view that conveyance by aërial currents was in operation at all.

The persons living in the Workhouse spent their whole days and nights in the closest possible proximity to the old hospital. How was it that there is such an absence of unexplained sources of infection? Let reference be made once more to that accurate and lucid account by the Matron of the spread by direct infection in the Workhouse buildings, which has been summarised on pp. 13 and 14, *ante*. Her facts and dates were most clearly and forcibly stated, and resisted the severest cross-examination. And again, the workers at the Brewery, breathing five times as much germ-laden (?) air all day as men do in repose at night, contributed only four cases out of a staff of 364 men, and there was no instance of unexplained source of direct infection among them.

On these grounds, therefore, and in view of the facts set forth in this and the three preceding sections, it may be affirmed that the diffusion of small-pox by aërial currents as above defined, was not an appreciable factor in the Warrington epidemic; and further, that a close examination of the facts renders it unnecessary to assume any such hypothesis.

TABLE LI.

Showing PARTICULARS of all the CASES of SMALL-POX among the WORKMEN at the DALLAM and BEWSEY FORGE from August 18th, 1892, to May 10th, 1893, with Remarks on the Source of Infection of those in September and October.

No. of Case.	Book Reference.	Name.	Age.	Date of leaving Work.	Date of Rash.	Date of Removal to Hospital.	Position in Forge at Time of Seizure, and Ref. No. on Map.	Home Address.	Remarks as to Source of Infection.
8	$\frac{\text{V.}}{1}$	C——, Emanuel	16	14th May	18th August	21st August	All over forge (0)	Guardian Street	Lived in highly infected district beside old hospital.
11	$\frac{\text{II.}}{20}$	B——, William	26	—	23rd „	24th „	7″ bar mill (12)	Winwick Street	Source of infection unknown.
21	$\frac{\text{VI.}}{6}$	B——, John	37	Worked all while son at home.	31st „	3rd September	(Near 2)	Howard Street	Previous case at home (Case 10).
22	$\frac{\text{V.}}{20}$	T——, Henry	37	—	3rd September	5th „	2 forge (5)	Priestley Srreet	Previous case at home (Case 6).
68	$\frac{\text{XIII.}}{17}$	P——, Thomas	27	18th September	20th „	22nd „	9″ and 10″ bar mills (13)	Pierpoint Street	Mother of Case 31 conveyed infection.
112	$\frac{\text{XIV.}}{8}$	C——, Edward	41	—	30th „	30th „	No. 1 sheet mill (3)	Cockhedge Lane	Previous case at home (Case 57).
138	$\frac{\text{XV.}}{3}$	K——, James	25	—	4th October	6th October	7″ and 8″ bar mills (12)	Dolman's Lane	Talking with patients over fence.
142	$\frac{\text{VI.}}{3}$	C——, Benjamin	20	3rd October	6th „	7th „	11″ and 14″ bar mills (10)	Howard Street	Next door, Case 63, rash $\frac{16}{\text{IX.}}$; never isolated.
150	$\frac{\text{XI.}}{15}$	G——, Joseph	28	3rd „	8th „	9th „	8″ and 9″ hoop mill (3)	Warburton Street	Walked across open spaces beside hospital, which at this time was not adequately shut off from hospital.
180	$\frac{\text{XII.}}{12}$	W——, James	15	—	12th „	16th „	9″ and 10″ bar mill (13)	Appleton Street	Communication with hospital.
354	$\frac{\text{XII.}}{\text{V.}}$	B——, John	31	—	12th „	0	Engine (8)	Owen Street	Free communication with hospital at back of his house.
188	$\frac{\text{XI.}}{7}$	N——, John	22	13th October	14th „	18th October	Smithy, fitting, and wheel shop (8).	Winwick Road	"Pals in hospital," whom patient visited.
189	$\frac{\text{XI.}}{26}$	W——, James	24	13th „	15th „	18th „	9″ and 10″ bar mills (13)	„ „	"Friends in bar mill."
193	$\frac{\text{XII.}}{2}$	B——, Albert	25	13th „	16th „	19th „	Wheel shop (8)	Dallam Lane	House close beside hospital, which was unisolated at this time.
235	$\frac{\text{IV.}}{20}$	B——, Robt.	17	17th „	16th „	21st „	7″ and 8″ bar mills (12)	Priestley Street	Two previous cases at home.
204	$\frac{\text{XIII.}}{11}$	G——, John	26	—	19th „	21st „	Scrap forge (2)	Pierpoint Street	No information (gone away).
208	$\frac{\text{XII.}}{31}$	H——, George	26	18th October	21st „	21st „	Wire mill (1)	Portland Street	Brother, Case 149, rash $\frac{6}{\text{X.}}$ whom he visited on the $\frac{7}{\text{X.}}$
219	$\frac{\text{XI.}}{31}$	B——, Albert	24	20th „	23rd „	24th „	Plate mill, smithy (8)	Winwick Road	Contact "with his chum Richard R—— (Case 114), who was in hospital from October 1 for 3 weeks."
222	$\frac{\text{XI.}}{9}$	H——, William	17	—	24th „	25th „	7″ and 8″ bar mills (12)	„ „	Two previous cases in adjacent houses.
227	$\frac{\text{XIII.}}{7}$	M——, Thos.	45	15th October	25th „	25th „	1, 2, and 4 sheet mills (3)	Pierpoint Street	Previous case at home, 169 $\frac{7}{\text{X.}}$ unisolated for two weeks.
243	$\frac{\text{XIII.}}{10}$	M——, Geo.	24	25th „	28th „	31st „	Plate laying on line (9)	„ „	Unisolated; Case 169 close by.
249	$\frac{\text{X.}}{18}$	S——, James	23	27th „	30th „	1st November	No. 3 sheet mill (7)	Watkin Street	Cases in adjacent houses.

TABLE LI—*continued.*

No. of Case.	Book Reference.	Name.	Age.	Date of leaving Work.	Date of Rash.	Date of Removal to Hospital.	Position in Forge at Time of Seizure, and Reference No. on Map.	Home Address.
297	XIII./26	J——, Henry	34	29th October	1st November	8th November	Foundry, joiners' and pattern shop (11).	Catherine Street.
369	X/23	H——, Wm.	17	2nd November	3rd „	0	Plate mill (8)	Philip Street.
270	XV./32	R——, Edward	22	3rd „	6th „	7th November	Foundry, joiners' and pattern shop (11).	Wright Street.
271	IX./6	P——, Edward	23	2nd „	6th „	7th „	7″ and 8″ bar mills (12)	Hardy Street.
276	II./7	R——, Chas.	36	—	6th „	7th „	Foundry, joiners' and pattern shop (11).	Kendrick Street.
283	II./39	M——, Geo.	42	—	7th „	8th „	All over forge (0)	Oliver Street.
286	II./21	T——, William	19	5th November	7th „	8th „	Foundry, joiners' and pattern shop (11).	Winwick Street.
293	XI./19	S——, Joseph	44	4th „	7th „	8th „	14″ mill (10)	Longford Street.
299	XIII./20	H——, Robt.	20	5th „	7th „	9th „	Foundry, &c. (11)	Catherine Street.
300	XIII./28	B——, Chas.	28	5th „	7th „	9th „	11″ mill (10)	Catherine Street.
312	X./13	P——, William	16	5th „	7th „	14th „	9″ and 10″ bar mills (13)	Watkin Street.
314	XI./20	A——, Jabez	42	—	7th „	14th „	7″ and 8″ bar mills (12)	Longford Street.
298	II./24	M——, John	25	5th November	8th „	9th „	All over (0)	Silver Street.
313	XI./30	A——, Henry	17	8th „	8th „	15th „	11″ and 14″ bar mills (10)	Winwick Road.
317	XIII./31	H——, Alfred	50	5th „	8th „	0	7″ and 8″ bar mills (12)	George Street.
330	X./11	T——, Chas.	21	29th October	8th „	15th November	7″ and 8″ bar mills (12)	Watkin Street.
306	XIII./16	F——, Alfred	23	7th November	9th „	15th „	Puddling forge (12)	Pierpoint Street.
310	XII./27	H——, Thos.	39	8th „	9th „	15th „	7″ and 8″ bar mills (12)	Buckley Street.
315	XI./25	H——, Edward	32	5th „	9th „	16th „	7″ and 8″ bar mills (12)	Winwick Road.
316	XI./18	S——, William	25	8th „	9th „	10th „	11″ bar mill (10)	Jockey Street.
318	III./2	C——, Edward	49	—	9th „	10th „	Foundry, joiners' and pattern shop (11)	Harts' Place, Bridge Street.
319	VII./8	S——, John	20	5th November	9th „	0	Boiler, &c., Bridge Yard (9).	Welfield Street.
326	XIII./2	W——, Richard	55	—	9th „	0	Smithy, fitting and wheel shop (8).	Lilford Street.
329	XI./24	R——, John	19	5th November	9th „	0	Foundry, joiners' and pattern shop (12).	Winwick Road.
324	VII./6	S——, John	28	—	9th „	—	Wire mill (1)	—
338	VIII./26	S——, James	24	—	9th „	15th „	7″ and 8″ bar mills (12)	Lincoln Street.
344	IX./3	E——, Jas.	36	5th November	9th „	0	7″ and 8″ bar mills (12)	Chorley Street.
325	IX./8	R——, Walter	17	8th „	10th „	0	All over (0)	Norman Street.
337	XIII./13	M——, John	40	8th „	10th „	17th November	7″ and 8″ bar mills (12)	Pierpoint Street.
335	V./17	P——, Jabez	32	8th „	10th „	17th „	7″ and 8″ bar mills (12)	Wakefield Street.
336	X./12	P——, Wm.	31	5th „	10th „	15th „	7″ and 8″ bar mills (12)	Watkin Street.
365	XII./12	S——, Percy	26	7th „	10th „	15th „	Boiler, &c., Bridge Yard (9).	Appleton Street.
357	XV./18	R——, Matthias	24	9th	11th „	17th „	7″ and 8″ bar mills (12)	Lord Nelson St.
358	II./12	M——, William	25	—	11th „	17th „	Foundry, &c. (11)	Cambria Place.
328	XIII./18	G——, Henry	32	8th November	12th „	0	Locomotive department (8).	Pierpoint Street.
355	XI./17	M——, William	23	8th „	12th „	16th November	7″ and 8″ mills (12)	Warburton Street.
356	XV./20	S——, Alfred	25	—	12th „	9th December	Smithy, fitting and wheel shop (8).	Admiral Street.
374	XII./13	S——, Richard	33	—	12th „	17th November	Scrap forge (2)	Appleton Street.
333	X./24	S——, Wm.	19	—	13th „	0	9″ mill (13)	Philip Street
375	V./22	S——, Jas.	21	12th November	15th „	19th November	Forge	Nicholson Street.

TABLE LI—*continued.*

No. of Case.	Book Reference.	Name.	Age.	Date of leaving Work.	Date of Rash.	Date of Removal to Hospital.	Position in Forge at Time of Seizure, and Reference No. on Map.	Home Address.
370	XIII. 8	W——, John	17	—	17th November	18th November	No. 3 sheet mill (7)	Pierpoint Street.
373	XI. 21	W——, John	38	16th November	17th „	0	Foundry, joiners' and pattern shop (11).	Longford Street.
387	VII. 19	S——, Joseph	16	—	19th „	0	Roll turning shop (8)	Froghall Lane.
388	XIII. 9	M——, Wm.	31	17th November	20th „	22nd November	Wire mill (1)	Pierpoint Street.
406	XI. 14	M——, Jas.	20	12th „	21st „	26th „	7″ and 8″ bar mills (12)	Amtrobus Street.
398	XII. 11	R——, Thos.	17	19th „	23rd „	25th „	11″ and 14″ bar mills (10)	Kerfoot Street.
392	XIII. 16	N——, Wm.	19	17th „	24th „	25th „	Forge all over (0)	Pierpoint Street.
408	X. 25	W——, Richd.	25	22nd „	25th „	27th „	No. 3 forge (6)	Philip Street.
416A	XI. 24	R——, Richd.	17	25th „	29th „	0	7″ and 8″ bar mills (12)	Winwick Road.
457	XIII. 29	McH——, John	17	3rd December	7th December	9th December	9″ and 10″ bar mills (13)	Hoyle Street.
473	V. 6	T——, James	42	—	19th „	19th „	Plate mill (8)	Knight's Yard.
484	XIV. 20	K——, James	40	22nd December	25th „	27th „	Bridge yard (9)	School Brow.
490	XIII. 21	G——, Wm.	37	—	31st „	4th January	Puddling forge (12)	Catherine Street.
496	XIV. 20	K——, Ernest	18	—	6th January	8th „	(9)	School Brow.
528	XIV. 5	S——, Richd.	26	—	25th „	26th „	Scrap forge (2)	Scotland Road.
574	XIX. 9	R——, John	33	—	14th March	15th March	14″ mill (10)	Morris Road.
581	XIX. 21	S——, Henry	19	—	24th „	25th „	No. 3 sheet mill (7)	Orford Lane.
602	XIX. 7	T——, Michael	18	—	1st April	3rd April	No. 4 hoop mill (3)	Portland Street.
605	XX. 1	A——, Joseph	21	—	5th „	6th „	Plate layer (nr. 9)	Wilson Pattern Street.
639A	XVIII. 10	H——, Wm.	25	—	12th „	0	Fitting shop (8)	Cartwright Street.
614	XIX. 6	C——, Wm.	14	—	14th „	14th April	No. 9 hoop mill (3)	Portland Street.
633	XVIII. 17	D——, Jos.	22	—	23rd „	25th „	10″ mill (13)	Workhouse.

Photo 4, p.8

ROYAL COMMISSION ON VACCINATION.

D^R SAVILL'S REPORT ON THE WARRINGTON SMALL POX EPIDEMIC 1892-3.

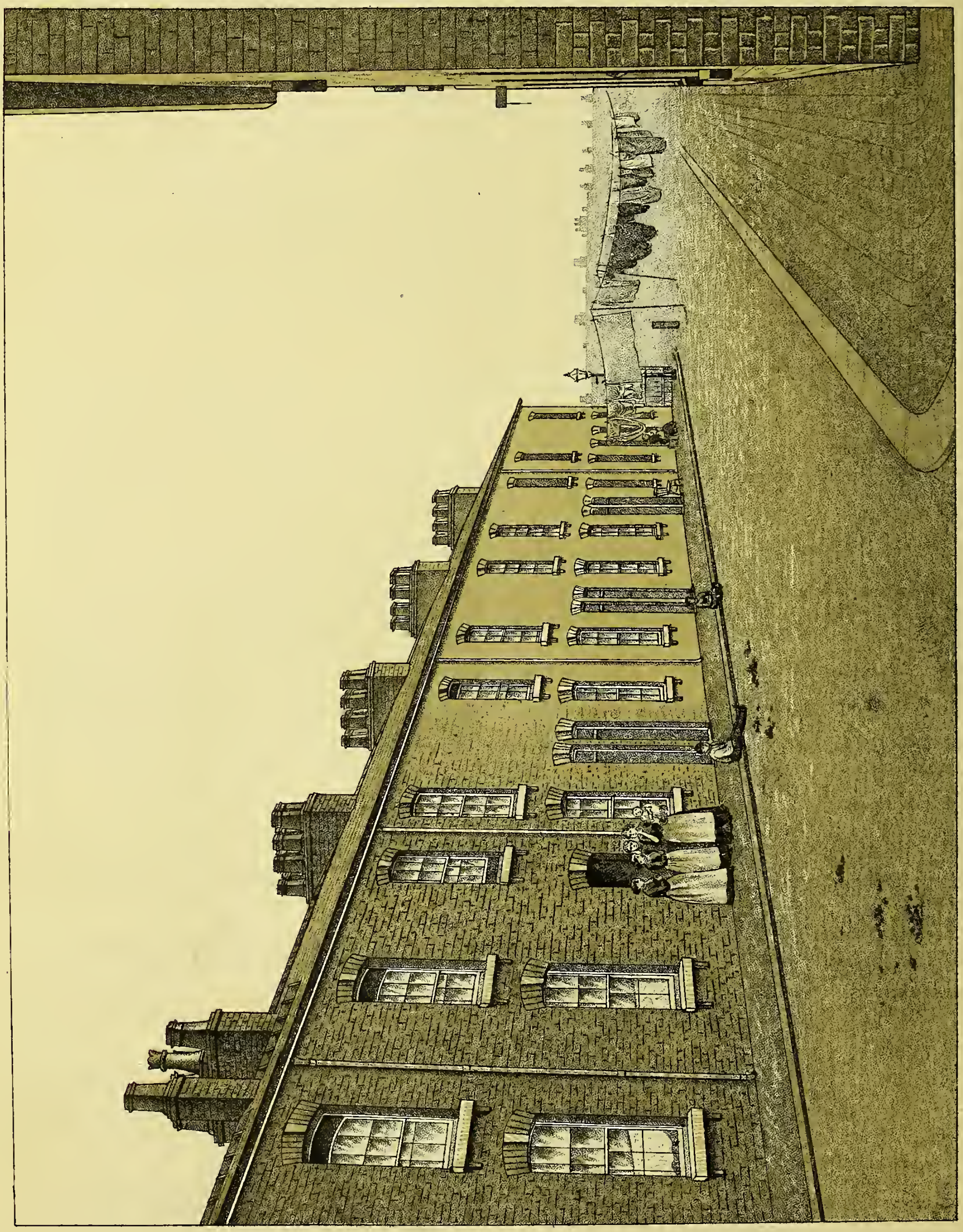

Photo 4. Owen Street, Warrington, showing the type of artizan dwelling uniform found in the town, and the common practice among the inhabitants of gossiping and playing in the streets.

PART IV.

Position and Sanitary Condition of Warrington; Social and Hygienic Condition of the People; Meteorology.

Having dealt in preceding parts with vaccination and other means specially directed to the prevention of small-pox, it will be necessary, in conclusion, to consider, without too much detail, the effect of the environments of the individual and various social and medical conditions which may in a more or less direct manner affect (*a*) the spread of the infection of small-pox, or (*b*) the severity of the disease, and to present them with a view to ascertain whether they may be regarded as contributory causes of the epidemic now under consideration.

There will be seven sections:—

		Page.
I.	The topography, area, and geology of the town	81
II.	Vital statistics and the relation of small-pox to occupation and social class	84
III.	Health of the community, prevalence of zymotic and other disease	88
IV.	Habits and social conditions of the people	91
V.	Sewerage and disposal of refuse	92
VI.	Water and food supply	93
VII.	The weather	94

SECTION I.—POSITION, HOUSES, AREA, AND SOIL OF THE TOWN.

Warrington is a manufacturing town situated in the southern part of Lancashire a little to the south of, and midway between, Liverpool and Manchester.

It was incorporated as a borough in 1847, and the present confines of the borough (*vide* Map I. at end), gives an area of 2,004 acres.

It is built on the north bank of a bend of the river Mersey, whose sluggish stream is much polluted with trade produce and sewage. The town itself is situated on a low-lying plain.

Four lines of railway run through or beside it, and there were at the time of my visit (1892–3) 147 factory chimneys emitting black smoke daily, Sundays only excepted.

A perpetual smoke hangs over the city like a pall, through which the sunlight only occasionally penetrates, and which seems to cast a shade over the inhabitants, whose sombre faces are a faithful index of their habits and occupations.

Streets and Spaces. (*See map I.*)

The streets are paved with the usual granite cubes, and the side walks mostly with black glazed tiles, but in some places the paths are made of ashes from furnaces.

There are four main streets running from about the centre, North (Horsemarket Street), South (Bridge Street), East (Buttermarket Street), and West (Sankey Street).

In the older parts of the town, notably on the east side of Bridge Street, Silver Street, Pinner's Brow and Cockhedge Lane, the houses are close together and often back to back, being approached only by some narrow alley-way, but in the newer parts of the town the streets are generally 30 or more feet wide. Here also at intervals are to be found open spaces which the inhabitants dignify with the name of "fields." They are for the most part old brick-fields where rubbish has been, and in some cases still is, shot. It is therefore artificially made ground. These spaces serve for play grounds for the children and resorts for the adults (Photo. 3, p. 68). The importance of these spaces as a means of spreading infection has frequently been mentioned in Parts I. and III. There is a small park beside the town hall.

Houses and Overcrowding.

The houses are very uniformly of a type considered suitable for artizan occupation—two-storied, four or six-roomed houses arranged in terraces, generally with a little back yard (Photo. 4 opposite).

The very usual size of the living-room, or "parlour-kitchen," is 11 or 12 feet square by about 7 feet high.

The disease certainly seemed to have a tendency to attack persons living in the smaller, and also the more crowded houses.

Taking the infected houses of the whole town, it may be seen, from Table V., p. 23, in Part II., that the infected houses contained an average of 5·8 inhabitants per house, as compared with 5·4 persons per house taking the whole town (*see* next page).

In the Aikin Street area, Table VI., p. 24, Part II., I had the opportunity of gauging from my own inquiries the relative numbers of persons living in the invaded and uninvaded houses respectively in one particular district, and it will be seen that whereas the uninvaded houses contained an average of 5·0 persons per house, the invaded houses in this area contained an average of 6·4 persons per house.

Nevertheless, in considering the question of over-crowding as a contributory cause in the spread of small-pox, it must be remembered that over-crowding may increase the chances of infection by more people going in and out of the house.

Area and Density of Population.

The area and confines of the Warrington town and Warrington Union have been altered several times in recent years since the incorporation of the town as a Borough in 1847. Finally in 1891 we find the following divisions :—

1. For Parliamentary and Registration purposes the district consists (as given in the 54th Annual Report of the Registrar-General, 1891) of—

——	Area.	Population.
	Acres.	
Sub-district Warrington - -	2,887	49,124
Sub-district Latchford - - -	3,820	7,979
Total - - - -	6,707	57,103

2. The Warrington Union, for Poor Law and Vaccination purposes, comprises the foregoing, together with other outlying sub-districts and townships, making a total area of 31,168 acres, and a population of 84,922. These figures are also taken from the Registrar-General's Report, 1891. Particulars may also be found in the Corporation's Year Book, 1892.
3. The Borough of Warrington, which corresponds with the Urban Sanitary District, and is the area dealt with in the foregoing pages, had in 1891 an area (as shown in Map I.) of 1,968 acres, on which stood 9,630 inhabited houses, and a total population of 52,743.

Table LII., given at foot, is constructed from particulars supplied to me by the Registrar-General, excepting the first column, which is the result of a survey made by the Corporation, and published in their proceedings of February 3rd, 1891.

The density of population varies considerably in different parts of the town, but, taking the borough as a whole, there were in 1892 :—

5·0 houses per acre,
5·4 persons per inhabited house, and
27 persons per acre.

The most densely populated portion of the town is St. John's Ward, *vide* Map I., which contains 66·8 persons per acre. (Table LII. gives further particulars.)

In order to arrive at some idea as to whether the density of population affected the spread of the small-pox it would be necessary to know—

(*a.*) The proportion between the per-centage of houses per acre in each ward, and the per-centage of infected houses in that ward ; and

(*b.*) The proportion between the per-centage of population per acre in each ward, and the attack-rate in that ward.

But even then the result might be considerably influenced by the ignorance, vice, dirt, and destitution which generally pervade the more densely populated parts of a town.

Geology.

The borough surveyor informs me that the soil on which the town is built consists for the most part of clay, which extends to an average depth of some 20 feet, covered by some 3 or 4 feet of loose surface earth, which generally consists of rubbish.* Near to the river, and for a depth of 30 or more feet beneath the surface quicksand is found. At the north-east corner of the town gravel and rocksand occur to a depth of about 15 feet, beneath which is the outcrop of the red sandstone.

On consulting the Memoirs of the Geological Survey of England and Wales, by the courtesy of the Curator of the Geological Museum in Jermyn Street, I find that Boulder Clay forms the surface soil for 14 miles east and west of Warrington, and 5 miles due north of the River Mersey, with here and there a small patch of Shirdly Hill Sand (post-glacial deposit), never more than about 100 square yards, and 6 or 8 feet thick. Thus, the soil on which the town, and the country for many miles round, is situated, is in the main a clay one. In Sankey Street there is a small patch of gravel, but at the Dallam Lane ironworks there is 23 feet of Boulder Clay, below which a norrow layer of sand (0–10 feet), separates it from tho rock below.

The rock beneath Warrington and the country for many miles is the Red Sandstone.

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* The well at the Whitecross Wire Works, not far from Aikin Street Hospital, passes (according to Dr. Ballard's Report on the Sanitary condition of Warrington presented to the Local Government Board, February 1872, p. 13) through—

3·0 ft. surface earth.
4·6 ft. clay,
2·6 ft. sand.
2·6 ft. marl.
10·0 ft. blue clay.
4·0 ft. sand.
1·0 ft. dirt, sand, and gravel.
9·0 ft. quicksand.
2·0 ft. gravel.
Rock.

TABLE LII.

SHOWING the NUMBER of HOUSES and INHABITANTS in each of the MUNICIPAL WARDS within the BOROUGH of WARRINGTON (as extended in 1890) from the Census Returns of April, 1891, corresponding with the URBAN SANITARY DISTRICT.

——	Area in Acres.*	Houses.			Population.		
		Inhabited.	Uninhabited.	Building.	Persons.	Males.	Females.
Bewsey Ward -	291	959	16	2	5,491	2,772	2,719
Fairfield „ -	323	967	18	11	4,956	2,403	2,553
Howley „ -	133	1,180	62	2	6,412	3,330	3,082
Latchford „ -	326½	1,086	15	8	5,785	3,018	2,767
Orford „ -	230½	832	20	22	5,303	2,926	2,377
St. Austin „ -	188	715	8	9	3,912	1,835	2,077
St. John „ -	131	1,685	58	13	8,760	4,336	4,424
Town Hall „ -	111	1,143	79	3	6,102	3,080	3,022
Whitecross „ -	234	1,063	10	39	6,022	3,070	2,952
Total -	1,968	9,630	286	109	52,743	26,770	25,973

* From the Proceedings of the Town Council, February 3, 1891.

TABLE LIII.

Showing the Sex—and Age—Distribution of the Population Enumerated at the Census in 1891 within the Borough of Warrington.

All Ages.		Under one year.	1.	2.	3.	4.	Under five years.	5.	10.	15.	20.	25.	30.	35.	40.	45.	50.	55.	60.	65.	70.	75.	80.	85.	90.	95.	and up-wards.
Persons.	Males and Females.																										
Persons - -	52,743	1,708	1,535	1,447	1,481	1,454	7,625	6,629	6,115	5,626	5,152	4,295	3,886	3,123	2,643	2,153	1,858	1,214	1,079	655	420	166	87	13	4		
Males - - -	26,770	861	773	712	732	714	3,792	3,287	2,964	2,910	2,678	2,249	2,052	1,661	1,408	1,099	936	601	529	295	201	70	28	8	2		
Females - -	25,973	847	762	735	749	740	3,833	3,342	3,151	2,716	2,474	2,046	1,834	1,462	1,235	1,054	922	613	550	360	219	96	59	5	2		

SECTION II.—VITAL STATISTICS AND THE RELATION OF SMALL-POX TO OCCUPATION AND SOCIAL CLASS.

Population.

In 1851 the census population was 22,894.
In 1861 ,, ,, ,, 25,953.
In 1871 ,, ,, ,, 32,144.
In 1881 ,, ,, ,, 41,452.
In 1891 ,, ,, ,, 52,743.

Between the dates of the Censuses of 1881 and 1891, the boundaries of the Urban Sanitary District of Warrington were altered. The population of the area now included was, at the date of the census of 1881, 42,552; thus showing an average annual increase of 1,019 during the last 10 years.

Now the natural annual increase, due to the excess of births over deaths, for the 10 years ending in 1891 is 856,* and therefore one is justified in presuming that the excess of immigration over emgration is a factor in the growth of the population.

It is worth while noting in passing that in the future this excess will probably be greatly increased, having regard to the newly completed Manchester Ship Canal, which is to have a lock less than two miles from the town.

The estimated population at Midsummer, 1892, was **54,084**, and this is the figure that has been taken in the calculations throughout this Report.†

Table LIII., on p. 83 *ante*, and Table LIV., given below, which have been supplied to me by the courtesy of the Registrar-General, give particulars concerning the sex, and age-distribution of the population, and the numbers and ages of persons engaged in the seven principal industries in the borough of Warrington.

Birth Rate, 1892.

The births during the 52 weeks of the year 1892 were:—

Males - - - -	1,111
Females - - -	1,056
Total - -	2,167

Birth rate 39·9.‡

Death Rate, 1892.

The total number of deaths during the 52 weeks ending December 31st, 1892, was 1,267, being 665 males and 602 females, 35 of these persons belonged to parts outside the borough of Warrington; and if these be deducted, the death-rate for the year 1892 was 22·77 per thousand, which is 1·86 lower than the year 1891.*

The several causes of death during the year 1891 are given in Part II., page 38, *ante*.

It will be noticed that the death-rate of Warrington is somewhat high.

Relation of Small-pox to Occupation.

With a view to ascertain the incidence of small-pox on the different occupations, I addressed a letter of inquiry to each of the leading employers of labour in Warrington, 48 in number, and in all cases received a reply containing the information required.

Table LV. gives a synopsis thereof.

It cannot be said from this that any occupation was particularly prone to take small-pox. One of the iron-works employing 182 men entirely escaped. Others had some of their men affected, and the largest, the Dallam and Bewsey Forge had, for reasons previously given, a very heavy incidence.

Fustian or velvet cutting, an important industry, is done almost entirely by girls and women, and is carried on in long rooms of various sizes. It will be noticed that some of these shops or rooms escaped. In others the attack-rate was very heavy. The occupation is a dusty one, attended by the formation of "fomites," and when once infection was introduced into a room, it spread amongst the girls working in that particular room, with great rapidity,—greater rapidity than it did in other occupations.

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* For particulars of these 10 years, *see* Medical Officer of Health's Report for 1892.

† This figure is taken from the Medical Officer of Health's Report for 1892.

‡ Medical Officer of Health's Report for 1892.

* Medical Officer of Health's Report for 1892.

TABLE LIV.

SHOWING the NUMBERS and AGES of PERSONS returned in the BOROUGH of WARRINGTON at the Census of 1891 as engaged in the seven principal Occupations.

Occupations.		Total.	Ages.							
			10.	15.	20.	25.	35.	45.	55.	65 and upwards.
Wire Workers - -	M.	1,020	68	242	156	260	150	89	43	12
	F.	7	1	4	1		1			
Blacksmiths - - -	M.	509	10	58	80	126	109	76	30	20
	F.									
Iron and Steel Workers -	M.	1,791	54	254	314	474	373	222	84	16
	F.									
Tanners - - -	M.	554	17	118	104	135	86	65	21	8
	F.	4		1			2	1		
Cotton Manufacture - -	M.	193	25	52	24	35	25	13	15	4
	F.	1,103	139	473	247	153	56	24	9	2
Fustian Manufacture -	M.	102	2	8	8	20	26	20	14	4
	F.	1,223	158	368	293	241	102	42	15	4
Brewer - - -	M.	149	14	16	31	31	16	24	15	2
	F.	3		1			1	1		

NOTE.—Among the brewers here are included only those, apparently, who are actually employed in brewing, not the draymen, labourers, and others.

TABLE LV.

Trades Inquiry.

Description of Trade and Name of Employer.	Department.	No. of Hands Employed.		Total.	Cases of Small-pox.
		M.	F.		
COTTON.					
Armitage & Rigby, Ld. (Cockhedge Mills).	Weaving shed -	26	680	706	9
	Mule spinning -	60	—	60	1
	Ring „ -	2	25	27	1
	Winding room -		120	120	—
	Twisting „ -		30	30	—
	Throstle „ -		50	50	—
	Card „ -	14	80	94	—
				1,087	
IRON.					
Monks, Hall & Co., Ld. (Monk's Forge).	Forge - -	195		195	9
	Mills - -	73		73	10
	Tube works -	88		88	2
				356	
Dallam and Bewsey Forge.	Forge, mills, and various shops.	2,075		2,075	83
Chandos Foundry -	- - -	*	*		*
Dallam Wire Works (W. Smith & Son).	Wire drawing -	70		70	5
	Mechanics' shop -	4		4	1
	Warehouse - -	6		6	1
	Spooling rooms -	8		8	1
	Patent house -	16		16	0
	Yard - -	9		9	2
	Round wire room office.	7		7	1
				120	
Whitecross Wire Works.	Rod mill wire rolling.	14		14	—
	Forges - -	62		62	—
	Rod mills wire rolling.	60		60	3
	Netting shop -	55		55	—
	Nail shop - -	10		10	—
	Galvanizing -	82		82	2
	Offices and stores -	20		20	1
	Cleaning house:—annealing pots.	14		14	—
	Rope mill - -	65		65	2
	Wire-drawing mill	180		180	1
	Rod mill - -	30		30	—
	Fitters, engine-drivers, stokers, joiners, and smiths.	100		100	—
				692	
Rylands, Bros., Ld. (Church Street Wire Works).	Oiling - -	4		4	1
	Galvanizing -	23		23	1
	Wire netting -	8		8	1
	Wire drawing -	83		83	4
	—— - -	582		582	—
				700	
N. Greening & Sons, Ld. (Crown Street Wire Works).	Wire weaving -	36	35	71	—
	Fitters, &c. -	42		42	—
	Wire cleaning -	7		7	—
	Engine-drivers -	2		2	—
	Joiners, &c. -	24		24	—
	Warehouse - -	7		7	—
	Needle winding -	17		17	—
	Clerks, &c. - -	12		12	—
				182	

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* For detailed particulars see page 74 *ante*.

Trades Inquiry.—*continued.*

Description of Trade and Name of Employer.	Department.	No. of Hands Employed.		Total.	Cases of Small-pox.
		M.	F.		
Longford Wire, Iron, and Steel Co., Ld.	Mattress - -	10	12	22	1
	Wire drawing -	27		27	1
	Galvanizing -	6		6	1
	Carriage seat -	6		6	—
	Cleaning - -	6		6	—
	Warehouse - -	8		8	—
	Fitters - -	6		6	—
	Labourers - -	68		68	—
				149	
Artingstall & Co., Ld. (Latchford Brush Works).	Wire weaving -	16		16	—
	Brush - -	5	2	7	—
				23	
W. Silcock & Sons (King Street).	Wire weaving -	21		21	1
Warrington Wire Rope Works (Bewsey Rd.).	Wire weaving -	86		86	—
SOAP BOILING, &C.					
Jos. Crosfield & Sons (Bank Quay).	Soap makers -	300		300	3
GLASS.					
Robinson, Skinner & Co., Ld. (Bank Quay).	Mould making and cleaning.	5	5	10	2
	Warehouse -	—	15	15	1
	—— - - -	125		125	—
				150	
Edward Bolton & Sons (Orford Lane).	Sorting-room -	1		1	1
	Glasshouse -	40		40	—
	Cutting - -	25		25	—
	Warehouse -	3	7	10	—
	Mould room -	3		3	—
	Engraving - -	2		2	—
	Yard, lodge, and office.	11		11	—
				92	
TANNING.					
J. & J. Tinsley (Mersey Street).	- - -	100		100	—
T. W. Nelson & Co., Mersey Street.	- - -	150		150	—
W. Reynolds & Co., Ld., Mersey Street.	- - -	65		65	—
J. T. Cunliffe, Ld., Howley.	- - -	15		15	—
J. H. Fleming & Co., Fennel Street.	- - -	70		70	—
Guest Bros., Wenwick Street.	- - -	25		25	—
A. Waring & Co., Ld., Wenwick Road.	Tanning - -	15		15	—
	Sizing - -	28	12	40	3
				55	
Tanners Lane Tanning Co. Ld.	- - -	50		50	1
Wm. Tinsley & Co., Latchford.	- - -	20		29	7
S. Reynolds, Latchford	- - -	40		40	—
Hy. Parkinson & Co., Latchford	- - -	30		30	—

TRADES INQUIRY.—*continued.*

Description of Trade and Name of Employer.	Department.	No. of Hands Employed.		Total.	Cases of Small-pox.
		M.	F.		
FILE AND TOOL WORKS.					
Peter Stubs, Ld., Scotland Road.		193	7	200	2
Thewles and Griffith, Mersey Street.	File	70		70	1
	Tool	100		100	—
				170	
Edelsten and Son, Latchford.		—	—	70	1
INDIA RUBBER WORKS.					
Castle Rubber Co., Ld., Ellesmere Street, Workshop.		10	90	100	2
Wharf Street Works		120	30	150	—
				250	
CHEMICALS.					
Roberts, Dale, & Co., Mersey Street.		20	—	20	—
Winser & Co., Bank Quay.	Alum	16	—	16	—
	Boiler firing	2	—	2	—
	Epsom salts	8	—	8	—
	Glauber salts	2	—	2	—
	Salufer	1	—	1	—
	Cooperage	1	—	1	—
				30	
SPELTER AND ZINC.					
Hy. Kenyon & Co., Bank Quay.		20	—	20	—
				20	
FUSTIAN CUTTING.					
Jas. Platt and Sons	Workshop. Bostock Street	1	56	57	5
	Aikin Street	2	82	84	14
	Bank Street	1	34	35	—
	Carlisle Street	1	47	48	—
	Cockhedge	5	60	65	—
	Hopwood Street		5	60	—
	Turner Street	1	43	44	—
	Lythgoes Lane	10	370	380	8
				773	
Jos. Wilkinson	Longford Street	—	90	90	4
	Eldon Street	1	45	46	1
	Wakefield Street	2	98	100	11
				236	
TIMBER AND SAW MILLS.					
R. A. Naylor	Joinery	42		42	1
	Turnery	20		20	1
	Sawyers	20		20	—
	Wheelwrights	6		6	—
	Japanners	6		6	—
	Machinists	12		12	—
	Smiths	5		5	—
	Carters	6		6	—
	Labourers	19		19	—
				136	

TRADES INQUIRY.—*continued.*

Description of Trade and Name of Employer.	Department.	No. of Hands Employed.		Total.	Cases of Small-pox.
		M.	F.		
CORN MILLERS.					
Jas. Fairclough and Sons, Mersey Mills.		76		76	—
Bank Quay Mills		21		21	—
Bridgefoot	Warehouse	2		2	—
				99	
ENGINEERING.					
Cheshire Lines Committee (Battersby Lane).		396		396	—
GAS STOVE MAKERS, &C.					
Fletcher, Russell, & Co., Ld. (Thynne Street).		200		200	—
Richmond & Co. (Academy Street).		120		120	2
PRINTING.					
Mackie & Co., Ld., Sankey Street.		120	80	200	—
BREWING.					
Peter Walker and Son, Dallam Brewery.	Brewing	163		163	1
	Yard	40		40	—
	Offices	18		18	—
	Coopers, &c.	44		44	2
	Fitters	14		14	1
	Bricklayers	26		26	—
	Joiners	15		15	—
	Carters	21		21	—
	Bottlers	23		23	—
				364	
DRAPERS.					
J. and W. Dutton, Sankey Street.		30	90	120	1
RAILWAYS.					
Cheshire Lines Committee, Station and Warehouses Central Station.		129		129	2
London and North-Western Railway Co.	Locomotive	253		253	9
	Permanent way	77		77	1
	Traffic	150		150	3
	Wagon	2		2	1
	Signal	41		41	—
	Carriage	5		5	—
				528	

RELATIONS OF SMALL-POX TO SOCIAL CLASS.

Social class is a condition somewhat difficult to gauge; but, with a view to show the social class of those persons affected with small-pox, compared with that of the town generally, a statement is here submitted (Table LV*a*.) showing the different rateable values of all the houses in the towns.

In the 38 houses rated at between 8*l*. and 16*l*. are included a good many in the occupation of two or more families. At any rate the whole of this group would be included among those occupied by the great "working class."

It will be seen that all but 11 of the infected houses are estimated to be rated at less than 16*l*. net rental per annum. One of these houses was in the occupation of a clergyman, but all the other 10 were occupied by tradesmen, who used their dwelling-houses as business premises. They were in the occupation of one butcher, one draper, one pawnbroker, three innkeepers, and four model lodging-house keepers,—persons, be it observed, whose callings naturally expose them to sources of direct infection. The disease was introduced into the clergyman's house by his wife taking flowers to the hospital, as mentioned in the Introduction (p. 3).

With these exceptions the small-pox was absolutely confined to the lower, or artisan, or working classes of society, whose gregarious habits pre-eminently favour the spread of the disease from person to person. This is another circumstance against the theory of aërial spread.

Causes of immunity of middle and upper classes.

The great majority, if not all, of the persons, living in 893 houses of 16*l*. and upwards were most certainly exposed to aërial currents from the hospitals. Most of them lived within 500 or 1,000 yards of one or other of the hospitals, why should they escape this supposed influence?

To this it might be answered:—

1. That their habits are more cleanly, which is undoubtedly true.
2. That they are more generally revaccinated. On this point no statistical information is available, but several of the doctors of the town informed me that this was undoubtedly a fact, and my own observations lead me to credit it.

In general terms each of these circumstances is undoubtedly true, and seems to me to aid in the explanation of the immunity of the middle classes from small-pox. But it is an equally indisputable fact that they do not mix so closely together, and it seemed to me that this helps to afford an explanation of the prevalence of small-pox among the lower classes of society in the Warrington outbreak 1892–93.

The question of social class is also referred to on p. 90.

TABLE LV*a*.

STATEMENT of Ratable Values of the 9,630 Inhabited Houses in WARRINGTON 1891, and the Houses Infected with SMALL-POX, as estimated by Collector of Borough Rates.

——	Houses rated at 8*l*. and under.	Houses rated at more than 8*l*. and less than 16*l*.	Houses rated at 16*l*. and over.
Number of houses of that value in the borough.	6,777	1,960	893
Number of houses infected by small-pox, 455, excluding fever hospitals and workhouse.	406	38	11
Per-centage - - - - -	**5·99**	**1·93**	**1·23**

SECTION III.—HEALTH OF THE POPULATION OF WARRINGTON.

PREVALENCE OF DISEASE.

The several causes of death during 1891, according to the Registrar-General's returns, are to be found on p. 38 *ante*.

Anœmia.

The large and growing industries in Warrington necessitate of course a great consumption of coal, and the smoke from these factory chimneys hangs perpetually over the town. This blackens the faces of the inhabitants, but I examined many of both sexes on Sundays when they were clean, and was struck by their pallor. This I found on investigation to be due to anæmia, caused, it seemed to me, by the impurity of the atmosphere they habitually breathe.

MEASURE OF HEALTH.

It may be taken that the means of measuring the health of the community by statistics are :—

(1.) The corrected death-rate.
(2.) The zymotic diseases death-rate.
(3.) The infantile death-rate.
(4.) Mean age at death.
(5.) Probable duration of life.
(6.) The expectation of life.

No Life Tables have been constructed to enable one to state particulars of the last three, but the following particulars, relative to the first three points, have been derived from the annual reports of the Medical Officer of Health for the years 1886 to 1892 inclusive.

1.—*Corrected Death-rate.*

The average corrected death-rate for the 10 years ending 1871, was 29·6 per thousand.

For the 10 years ending 1881 it was 23·5 per thousand.

For the five years ending 1886 it was 21·2 per thousand.

During the twelve months ending,—

December 31, 1886, the corrected death-rate was 20·7 per thousand.
December 31, 1887, 23·5 per thousand.
December 31, 1888, 20·6 per thousand.
December 31, 1889, 22·1 per thousand.
December 31, 1890, 22·7 per thousand.
December 31, 1891, 24·6 per thousand.
December 31, 1892, 22·7 per thousand.

It follows from these figures that the average corrected death-rate in the town of Warrington from all causes during these thirty-one years, was 23·12 per thousand of the population per annum. For purposes of comparison, it may be mentioned that in the Town Districts of England and Wales during the 10 years 1861–70 the annual death rate was 24·8, 1871–80 it was 23·1, and 1881–90 it was 20·3.

2.—*Zymotic Disease.*

It will be seen from the tables of deaths and notifications (below) that zymotic diseases of different kinds are very prevalent in the town. Scarlet fever, measles, whooping cough, diphtheria, diarrhœa, and enteric fever are endemic.

Mention has already been made (p. 41) of the prevalence of small-pox, especially in former times.

Typh Fever

In 1872 an inquiry was instituted by the Local Government Board, in consequence of the apparently high death-rate from "fever," as exhibited in the quarterly reports of the Registrar-General. Dr. Ballard in his report states that the form of fever which was prevalent, was mainly typhus, epidemics of which disease had previously occurred in 1865, 66, and 67. As in the small-pox epidemic of 1892, the fustian cutters suffered severely. This gentleman attributed the fever to back-to-back, ill-ventilated houses, neglected midden-closets, bad and deficient water supply, and deficient arrangements for dealing with outbreaks of epidemic disease.

In 1881 the zymotic diseases death-rate was 2·0 per 1,000 of the population.
In 1882 the zymotic diseases death-rate was 5·8,
In 1883 the zymotic diseases death-rate was 2·7,
In 1884 the zymotic diseases death-rate was 4·7,
In 1885 the zymotic diseases death-rate was 1·2,
In 1886 the zymotic diseases death-rate was 2·3,
In 1887 the zymotic diseases death-rate was 5·0,
In 1888 the zymotic diseases death-rate was 4·15,
In 1889 the zymotic diseases death-rate was 4·22,
In 1890 the zymotic diseases death-rate was 3·88,
In 1891 the zymotic diseases death-rate was 3·15,
and in 1892 the zymotic diseases death-rate was 3·9 per 1,000 of the population.

The following table (Table LVI.,) shows an analysis of the deaths, and it will be seen that zymotic disease in all forms is a very frequent and fatal visitor to the town of Warrington. In the six years ending 1892, it accounts for no less than 1,226 deaths, or 12·5 per cent. of an average population of 45,000.

TABLE LVI.

Showing NUMBER of DEATHS and the DEATH-RATE from the several ZYMOTIC DISEASES in WARRINGTON, 1887–1892.

—	Small-pox.		Scarlet Fever.		Measles.		Whooping Cough.		Diphtheria.		Diarrhœa.		Typhus.		Enteric Fever.		Total Deaths from Zymotic Diseases.	Total Death-rate per 1,000 of Population from Zymotic Diseases.
	Number of Deaths.	Death-rate per 1,000 of Population.	Number of Deaths.	Death-rate per 1,000 of Population.	Number of Deaths.	Death-rate per 1,000 of Population.	Number of Deaths.	Death-rate per 1,000 of Population.	Number of Deaths.	Death-rate per 1,000 of Population.	Number of Deaths.	Death-rate per 1,000 of Population.	Number of Deaths.	Death-rate per 1,000 of Population.	Number of Deaths.	Death-rate per 1,000 of Population.		
1887. (Population 47,264.)	0	0	1	·02	134	2·83	46	0·97	4	0·08	48	1·01	1	0·2	6	0·12	240	5·08
1888. (Population 47,464.)	2	0·04	77	1·62	1	·02	58	1·22	5	0·10	43	0·90	1	0·2	9	0·19	*197	4·15
1889. (Population 49,000.)	0	0	32	0·65	91	1·85	32	6·65	8	0·16	36	0·73	0	0	8	0·16	207	4·22
1890. (Population 50,000.)	0	0	16	0·32	33	0·66	56	1·12	17	0·34	57	1·14	0	0	15	0·30	194	3·88
1891. (Population 53,000.)	0	0	9	0·18	80	1·4	19	0·36	11	0·20	41	0·77	0	0	14	0·26	174	3·30
1892. (Population 54,084.)	55	1·01	66	1·22	13	0·24	37	0·68	7	0·13	26	0·48	0	0	11	0·20	214	3·9

* In 1888 there was one death from relapsing fever.

3.—*Infantile Mortality.*

In Tables LVIII. and LIX. given below are to be found particulars of the infant mortality for the different years based on the details given in the annual reports of the Medical Officer of Health, and it will be seen that the infant mortality is high in the town of Warrington.

TABLE LVII.

Infantile Mortality in Warrington, 1880–1892.

—	Number of Deaths under 1 year of Age.	Proportion to 1,000 Births Registered.	Number of Deaths under 5 years.	Per-centage of Deaths under 5 years to Deaths at all Ages.
Average of 5 years, 1880–1884.	—	152	—	51·4
1885.	243	132	—	41·8
1886. (Population, 46,343.)	293	158	464	47·2
1887. (Population, 47,264.)	317	170	584	52·0
1888. (Population, 47,464.)	277	147	495	49·0
1889. (Population, 49,000.)	318	163	570	52·6
1890. (Population, 50,000.)	351	171	583	51·5
1891. (Population, 53,000.)	350	155	595	44·4
1892. (Population, 54,084.)	341	157	608	49·4

SECTION IV.—HABITS AND GENERAL CONDITIONS OF THE INHABITANTS.

Floating Population.

The majority of the people of Warrington are of fairly settled habits, and the usually thriving state of the industries affords them settled occupation.

But owing to its position on the high road to and from Manchester, Liverpool, and Birmingham, there is a considerable floating population. The returning officer states that there are annually between seven and eight thousand changes of address either to different parts of Warrington or to and from other towns.

The important part played by the common lodging-houses may be gathered from the facts previously narrated, and it will be seen that the very origin of the epidemic was a case arising in the floating population.

The ship canal works, which are about a mile from the town, largely supply the occupants of the common lodging-houses, and it was in one of these labourers in whom Case I. occurred.

Those among the inhabitants who are of more fixed abode are in the habit of passing in and out of each other's houses, instances of infection from which have been mentioned.

The children play together in the streets or in the open spaces, the so-called "fields" to which reference has so frequently been made, and all these circumstances combine to favour the propagation of the disease; indeed, it would seem from an examination of all the foregoing facts that the disease does but follow here, as it does elsewhere, the lines of human contact and intercourse.

Day of Week for the Eruption of Small-pox.

In some epidemics it has been shown that Sunday was the favourite day of the week for the development of the eruption, and therefore presumably Sunday (14 days before) was the day of infection; the following particulars show the relative number of cases who developed the eruption on each day of the week in the Warrington epidemic 1892–93.

119 cases developed the eruption on a Wednesday.
102 ,, ,, ,, ,, Sunday.
93 ,, ,, ,, ,, Tuesday.
91 ,, ,, ,, ,, Saturday.
91 ,, ,, ,, ,, Thursday.
87 ,, ,, ,, ,, Friday.
84 ,, ,, ,, ,, Monday.

No explanation can be offered why Wednesday takes a slight lead. Sunday is not far behind, and there is not a very large difference between any.

Fêtes and festivals may have played an important part in the propagation of the disease, and a good many people attributed their infection with more or less reason to a fête known as "Walking Day" when all the school children parade the streets, and their parents flock to see them, or to a fire which occurred in Bewsey Street.

Intelligence.

The intelligence of these people seemed to me to be distinctly below the average of the present day, and certainly it is hard to imagine people more ignorant of the primary rules of health and cleanliness than those amongst whom I conducted my inquiries.

A considerable proportion of the adults could neither read nor write, nor even spell their own names correctly, circumstances which have sometimes given rise to difficulty. But the fact which struck me most was their almost invariable practice of sitting down to meals without washing the dirt of their occupation off their hands or faces.

Instances of ignorance as regards infection were numerous. The Medical Officer of Health informed me that in the early part of November 1892, the father of a family developed the rash of small-pox, and was about to be removed to the hospital, so his wife sent to fetch the children from school in order that they might say good-bye to their father.

In another instance the Medical Officer of Health found several women in the bedroom of a patient known to have small-pox, holding a farewell tea-party.

An enquiry was held on November 5th on the body of a child of eight, who died November 3rd, and it was elicited that the child had been ill for a week, whilst the mother and father were "on the drink," and the verdict was "that death was due to small-pox accelerated by neglect."

It seemed to me as I went from house to house, day after day, amongst this population, that it would be somewhat irrational to consult some of these folk on the propriety of their disinfection, isolation, and vaccination, if these means were decided to be necessary for their protection from small-pox on scientific grounds.

Intemperance.

Not many instances of immorality came to my notice, but intemperance is very rife amongst all classes. Large quantities of alcohol are consumed in the public-houses, inns, and little beer-shops, one or more of which could be found in nearly every street in the town. According to the report of the chief constable of the town for the year ending 29th December 1892, (p. 13), there were in that year—

88 licensed victuallers,
48 beer-house keepers, and
73 off-license holders.

There were 680 charges of drunkenness during that year. This was nearly 100 below the average of preceding ten years. 424 males were convicted, and 50 were discharged, 149 females were convicted and 57 discharged.

The Irish nationality formed a numerous contingent in the town and contributed very largely to the small-pox cases.

Wages.

The wages earned by labourers amount to 18*s.* or 20*s.* a week; a skilled artizan would earn from 25*s.* to 40*s.* a week and upwards, varying from week to week, because the greater part of the work is piece-work. There did not seem to me to be an undue proportion of want or destitution amongst the lower classes, and if it were not for the large sums of money spent in drink, they would be, so far as I could judge, affluent people.

The question of social class is also referred to on p. 87.

SECTION V.—SEWERAGE AND DISPOSAL OF REFUSE.

SUB-SECTION *a*.—LIQUID REFUSE AND SEWERS.

Nothing in this inquiry led me even to suspect that the disposal of refuse had any influence whatever on the propagation of small-pox.

Warrington was one of the earliest towns to adopt the pail-closet system in place of the middens, which formerly, when typhus was so prevalent, existed.

By reason of its flatness and the lowness of its elevation, Warrington is badly situated for a proper arrangement of sewers.

Its altitude varies only between 23 feet (approximate mean water at Liverpool in Mersey Street beside the river) and 50 feet in the higher N.E. corner of the town, a distance of about one mile.

Nevertheless, nearly all the streets are sewered for the purpose of conveying surface water, slops, and waste, The fall of these varies from about 1 in 100 to 1 in 1,000. There are two outfalls in the Mersey and *one* into the Sankey Brook; the two former are tide-locked. The Bank Quay out-fall, the main one, is only 6 feet above ordinary low-water mark. The rise and fall of the tide is normally 16 ft. and the outlet is completely tide-locked for about 2½ hours under ordinary circumstances. Flood tides rise 25 feet, almost to the level of Mersey Street.

It is reckoned that there are only 400 water-closets in the town, the rest of the houses having pail-closets, consequently this system of sewage is not so objectionable as it otherwise might be.

SUB-SECTION *b*.—THE DISPOSAL OF EXCRETA.

There are about 9,000 houses dependent upon the pail system for the disposal of solid and fluid excreta.

The pails which contain nothing more than excreta are taken through the back yards of the houses once a week and carted to the intercepting depôt in the town, there to be emptied, disinfected, and cleansed. The excreta are then forced through pipes to a distance of about half-a-mile by pneumatic pressure from a Shone pump, to the Longford works outside the town; where they are evaporated and made into *poudrette* by means of heat generated chiefly from the ashes and the refuse of the town.

Theoretically it is a very perfect principle, and in practice I was informed that, if it were not for the distance, it could almost be made to pay its own working.

It is a point worthy of note that in the worst part of the town where, as in Morris's Yard, Knowles' Yard, &c. &c., small-pox was rife, privies, used in common are placed a little way from the houses, in a place accessible to several adjacent houses where they exercise little or no effect upon the health of the inmates.

SUB-SECTION *c*.—REMOVAL OF ASHES AND OTHER SOLID REFUSE.

This is also effected in pails, entirely separate from the excreta; these pails are emptied into carts in the street and the refuse carted direct to the Longford depôt, there to be burnt in furnaces which generate the steam for the evaporation of the manure.

These pails also are removed once a week, and the whole of this, and of the carting of the excreta is done during the day-time.

It might be thought that such a means of disposal of excreta and ashes lent itself to the propagation of small-pox, and therefore I very carefully enquired for any cases amongst the 75 men employed in this work who come into contact more or less with the excreta and refuse, and who some of them were in the constant practice of going in and out of the infected houses.

Of these only one was attacked by the disease, and he had been for a few weeks preceding his attack, temporarily employed on ambulance work removing cases of small-pox, and clothes for disinfecting.

This circumstance alone seems to negative any idea that small-pox is propagated by means of the pail system.

SECTION VI.—WATER AND FOOD SUPPLY.

SUB-SECTION a.—WATER SUPPLY.

Warrington was in great trouble for many years by reason of the bad quality and small quantity of its water, and it is only recently that by borings at Winwick a system of waterworks has been provided for the town.

The water supply was not specially investigated, but as far as my inquiries went, there was not the faintest reason to trace any connexion between small-pox and the water supply of the town.

The main supply is derived from Winwick, a northern suburb about two miles away, where the water is pumped from an artesian well in the red sandstone.

There is also a supply derived from the south of the town, surface water being collected, but I was informed by the borough surveyor that it was used solely for manufacturing purposes.

SUB-SECTION b.—THE MILK SUPPLY.

No facts came under my notice which at all suggested the influence of the milk supply in the spread of the disease.

SUB-SECTION c.—FOOD SUPPLY.

Nor was the food supply, so far as I could ascertain, an unusually important factor in the spread, apart from the personal contact of the persons conveying the food in the manner mentioned in the foregoing portions of the report.

SECTION VII.—THE WEATHER.

The latter part of 1892 was rather inclined to be wet and also to be cold, but otherwise there was nothing abnormal about the year 1892.

The winter of 1892–3 has generally been regarded as a cold one; and there were a good many days on which the thermometer in exposed places reached freezing point, and especially between December 26th, 1892, and January 7th, 1893.

The following table of records, carefully taken by the Medical Officer of Health at the Aikin Street Observatory, which is within the hospital grounds, and supplied to me by the courtesy of that gentleman, gives full particulars of the meteorology of the town between July 1st, 1892, and March 31st, 1893.

I have made a careful study of these records, but have failed to note any practical connexion between the state of the weather and the small-pox epidemic in Warrington in 1892, and I am inclined to respectfully endorse the remarks of that careful observer, Dr. Thomas Percival, which he made in 1789, but which seem to me as true to-day as they were 100 years ago:—"No " one can doubt that variations in the heat, moisture, " dryness, temperature, and other qualities of the air, " must influence a disease, which is always of an " inflammatory, and often in the last stages of a " putrid nature. But the progress of it cannot be " regulated by the seasons, because it is derived from " contagion: the communication of which frequently " depends upon accident, is confined to no period of " time, and is varied by its degree of malignancy. " During the last visitation of small-pox at Warrington, " the state of the atmosphere went through all possible " changes, but with no perceptible difference in the " circumstances of the disease."

TABLE LVIII.

GIVING METEOROLOGICAL RECORDS of the TOWN of WARRINGTON, from July 1, 1892, to March 31, 1893, made at the AIKIN STREET HOSPITAL under the supervision of Mr. JOHN H. GORNALL, Medical Officer of Health.

Date.		Hygrometer.		Temperature.		Rain.	Wind.		Weather.		Remarks.
		Dry Bulb.	Wet Bulb.	Max.	Min.		Directions.	Anemometer. Total in Day.	At 9 am.	In previous 24 hours.	
						Inches.		Miles			
1892, July	1	59	56	66	44		N.W.	165	F.	Fine.	
”	2	59	55	71	54		S.W.	100	F.	”	
”	3	60	54	75	56	·50	S.W.	80	F.	Stormy.	
”	4	56	52	64	53	·10	S.W.	100	C.	Fine.	
”	5	58	56	64	50	·06	S.W.	200	C.	”	
”	6	55	52	62	48	·40	S.W.	100	C.	Cloudy.	
”	7	59	55	63	54	·06	S.W.	220	C.	”	
”	8	55	50	65	49	·05	S.W.	370	C.	Fine.	
”	9	55	52	61	49	·10	S.W.	100	F.	Cloudy.	
”	10	56	54	65	52		N.W.	620	C.	”	
”	11	54	51	68	46		N.E.	200	F.	Fine.	
”	12	56	55	62	47		N.E.	200	F.	”	
”	13	52	49	62	49		N.E.	100	F.	”	
”	14	55	52	61	51		S.E.	50	C.	”	
”	15	54	50	65	50	·50	S.E.	230	C.	Cloudy.	
”	16	52	51	56	51	·22	S.E.	100	C.	”	
”	17	54	50	56	49		E.	330	F.	Fine.	
”	18	49	47	59	45		N.E.	100	F.	Cloudy.	
”	19	53	51	56	46	·65	N.W.	195	C.	Stormy.	
”	20	53	50	63	50		N.E.	395	F.	Cloudy.	
”	21	56	53	65	51		N.E.	175	C.	Fine.	
”	22	55	54	66	45		N.E.	180	C.	”	
”	23	56	55	66	51		N.	125	F.	”	
”	24	59	55	73	51		E.	100	F.	”	
”	25	52	50	71	46		S.E.	70	F.	”	
”	26	52	50	62	48		S.E.	100	C.	”	
”	27	52	50	68	49		S.E.	60	F.	”	
”	28	54	51	69	44		N.E.	100	F.	”	
”	29	55	51	67	46		S.E.	75	F.	”	
”	30	56	52	65	44		S.E.	100	F.	”	
”	31	58	56	62	46	·06	S.E.	30	C.	Stormy.	
1892, August	1	59	57	64	56		N.E.	780	C.	Cloudy.	
”	2	55	53	64	50	·04	N.E.	100	C.	Fine.	
”	3	58	56	66	54	·04	N.W.	125	C.	Cloudy.	
”	4	54	50	61	49	·02	N.E.	100	F.	”	
”	5	50	52	64	49		N.W.	100	C.	Fine.	
”	6	56	54	65	52		S.W.	340	F.	”	
”	7	55	51	63	46	·55	S.E.	300	F.	”	
”	8	57	56	64	53	·40	S.W.	125	C.	Cloudy.	
”	9	54	49	62	51	·04	N.E.	100	F.	Fine.	
”	10	37	37	62	35		S.E.	115	F.	”	
”	11	46	46	68	37		N.E.	100	F.	”	
”	12	59	55	71	45	·08	S.E.	150	F.	”	
”	13	57	55	66	54	·30	S.W.	100	C.	Cloudy.	
”	14	62	57	67	55	·05	S.W.	475	F.	Fine.	
”	15	59	55	68	54		S.W.	100	F.	”	
”	16	56	54	65	52		S.	200	F.	”	
”	17	61	60	69	55		S.E.	115	F.	”	
”	18	57	55	65	54		S.E.	100	F.	”	
”	19	56	54	68	51		S.E.	115	F.	”	
”	20	52	51	73	45		S.E.	100	F.	”	
”	21	62	59	75	51		S.E.	530	F.	”	

TABLE LVIII.—*continued.*

Date.	Hygrometer.		Temperature.		Rain.	Wind.		Weather.		Remarks.
	Dry Bulb.	Wet Bulb.	Max.	Min.		Direction.	Anemometer. Total in Day.	At 9 am.	In previous 24 hours.	
					Inches.		Miles.			
1892, August 22	63	62	75	61		S.E.	100	F.	Fine.	
,, 23	59	55	74	53	·20	S.E.	200	F.	Cloudy - -	Thunder.
,, 24	58	56	72	56		S.E.	100	F.	Fine.	
,, 25	60	54	67	52	·06	S.E.	200	F.	,,	
,, 26	59	55	63	52		N.W.	135	F.	,,	
,, 27	52	51	63	49	·12	S.W.	50	F.	,,	
,, 28	52	51	64	49	·04	S.W.	55	F.	,,	
,, 29	52	50	66	47	·85	S.E.	70	C.	,,	
,, 30	60	56	66	51	·20	S.E.	100	C.	Cloudy.	
,, 31	57	55	59	54	·14	S.W.	100	C.	,,	
1892, September 1	53	50	66	49	·15	S.W.	100	C.	,,	
,, 2	54	52	63	51	·24	S.W.	125	C.	,,	
,, 3	50	49	64	50	·24	W.	200	C.	,,	
,, 4	63	62	57	46	·02	N.W.	225	F.	Fine.	
,, 5	50	46	59	42		N.W.	340	F.	,,	
,, 6	52	48	62	49	·24	N.W.	100	F.	,,	
,, 7	55	52	59	51	·06	S.W.	100	C.	Cloudy.	
,, 8	49	48	62	44	·02	N.E.	95	F.	Fine.	
,, 9	49	48	59	42	·07	E.	100	C.	,,	
,, 10	57	56	63	46	·09	S.E.	100	C.	,,	
,, 11	55	53	63	50	·20	S.E.	545	C.	Cloudy.	
,, 12	56	55	66	52	·04	S.W.	100	F.	Fine.	
,, 13	60	57	65	55	·10	S.W.	105	F.	,,	
,, 14	50	49	63	45		N.W.	100	F.	,,	
,, 15	54	50	60	49	·02	S.W.	50	C.	,,	
,, 16	52	50	59	50	·02	S.W.	55	C.	,,	
,, 17	47	45	60	41		S.W.	100	F.	,,	
,, 18	48	46	64	40	·12	S.W.	100	F.	,,	
,, 19	59	57	63	46	·08	S.W.	95	F.	Cloudy.	
,, 20	55	54	59	52	·65	S.W.	200	F.	,,	
,, 21	50	48	54	48	·10	S.E.	100	C.	,,	
,, 22	50	46	64	46		S.E.	25	C.	,,	
,, 23	52	50	63	48	·18	S.E.	100	C.	Fine.	
,, 24	54	52	59	51		S.W.	200	C.	,,	
,, 25	54	51	63	45		N.W.	400	F.	,,	
,, 26	54	51	64	47	·06	S.W.	200	F.	,,	
,, 27	59	54	62	53	·38	S.W.	265	C.	Cloudy.	
,, 28	46	45	55	45	·50	S.W.	200	C.	Stormy.	
,, 29	44	42	56	41	·14	S.W.	200	C.	Cloudy.	
,, 30	42	41	55	41		S.W.	100	C.	,,	
892, October 1	44	42	55	40	·50	S.W.	200	C.	,,	
,, 2	43	41	56	40	·06	S.W.	265	C.	,,	
,, 3	47	46	51	41	·48	S.W.	100	C.	,,	
,, 4	45	44	53	41	·06	S.W.	200	C.	,,	
,, 5	40	39	51	37	·09	S.W.	100	C.	,,	
,, 6	46	45	54	38	·19	S.W.	125	C.	,,	
,, 7	45	44	51	42	·45	S.W.	200	C.	,,	
,, 8	45	44	50	44	·24	N.W.	100	C.	,,	
,, 9	50	48	51	44	·40	N.W.	50	C.	,,	
,, 10	47	46	53	45	·14	N.W.	200	C.	,,	
,, 11	40	39	52	39	·06	S.W.	100	C.	,,	
,, 12	41	39	51	36		N.E.	125	F.	Fine.	
,, 13	46	44	54	40	·08	N.E.	100	C.	Cloudy.	
,, 14	54	51	54	44	·32	N.E.	100	C.	,,	

TABLE LVIII.—*continued.*

Date.		Hygrometer.		Temperature.		Rain.	Wind.		Weather.		Remarks.
		Dry Bulb.	Wet Bulb.	Max.	Min.		Direction.	Anemometer. Total in Day.	At 9 a.m.	In previous 24 Hours.	
						Inches.		Miles.			
1892, October	15	45	47	52	47	·35	N.E.	200	C.	Cloudy.	
„	16	43	39	48	39	·02	N.	50	C.	„	
„	17	36	35	49	34		N.	90	C.	Fine.	
„	18	33	33	49	30		N.	125	F.	„	
„	19	33	33	49	30		N.	400	F.	Cloudy.	
„	20	42	40	51	31	·42	N.E.	100	F.	„	
„	21	44	42	46	40	·06	N.E.	200	C.	„	
„	22	36	34	44	34	·08	N.E.	100	F.	„	
„	23	41	40	46	33	·24	N.	175	C.	„	
„	24	37	36	44	36		N.	200	C.	„	
„	25	31	31	42	26		N.	200	F.	Fine.	
„	26	26	26	45	23	·15	N.	125	F.	Cloudy.	
„	27	46	42	57	24	·09	N.E.	100	F.	„	
„	28	55	52	64	39	·04	S.W.	200	C.	Fine.	
„	29	55	54	59	51	·02	S.W.	300	C.	Cloudy.	
„	30	36	35	53	35		E.	35	F.	Fine.	
„	31	34	34	49	30		N.E.	75	F.	Foggy.	
1892, November	1	30	30	38	26		S.E.	100	F.	„	
„	2	34	34	46	25	·10	S.E.	100	F.	„	
„	3	45	44	55	32		S.W.	200	F.	„	
„	4	53	50	56	44	·15	S.W.	60	C.	Cloudy.	
„	5	50	49	57	47	·14	S.W.	100	C.	„	
„	6	46	45	50	42	·09	S.W.	25	C.	„	
„	7	41	40	45	36	·02	S.W.	108	C.	„	
„	8	39	38	49	35		S.W.	25	C.	Fine.	
„	9	44	42	52	38	·05	S.W.	100	F.	Cloudy.	
„	10	46	45	52	42		S.W.	100	C.	„	
„	11	45	45	54	44		S.	25	C.	„	
„	12	44	42	52	42	·12	S.E.	100	C.	„	
„	13	51	49	54	42	·20	S.E.	75	C.	„	
„	14	53	51	57	45		S.W.	25	C.	„	
„	15	49	47	52	48		S.E.	75	C.	Foggy.	
„	16	45	45	46	45		S.W.	25	F.	„	
„	17	37	36	39	36		N.E.	70	C.	„	
„	18	35	35	44	32		S.W.	100	C.	Cloudy.	
„	19	43	41	45	34	·32	S.E.	25	C.	„	
„	20	45	44	47	42		S.E.	70	F.	Fine.	
„	21	39	39	49	35		S.E.	25	F.	„	
„	22	42	40	45	38		S.E.	25	C.	Cloudy.	
„	23	43	41	45	38		S.E.	25	F.	Fine.	
„	24	41	40	44	40		S.E.	15	C.	Cloudy	
„	25	41	38	45	40	·12	S.E.	50	F.	Fine.	
„	26	45	43	49	40	·30	S.W.	15	C.	Cloudy.	
„	27	42	42	50	40		S.W.	95	F.	Fine.	
„	28	46	45	54	42	·08	S.W.	50	C.	Cloudy.	
„	29	46	43	48	45	·12	S.W.	25	C.	„	
„	30	39	35	45	35	·05	S.W.	25	C.	„	
1892, December	1	40	39	47	39		S.W.	160	C.	Cloudy.	
„	2	27	27	37	26	·10	N.W.	50	F.	Foggy.	
„	3	37	36	45	25	·15	S.W.	75	C.	Cloudy.	
„	4	33	32	36	31	·12	N.W.	200	C.	„	Snow.
„	5	32	32	39	25	·30	N.W.	205	C.	„	Snow Storm.
„	6	36	35	40	22	·18	S.W.	655	C.	„	
„	7	32	32	38	30		N.E.	125	F.	Fine.	
„	8	28	28	37	24	·25	N.E.	50	C.	Snow.	

TABLE LVIII.—*continued.*

Date.	Hygrometer.		Temperature.		Rain.	Wind.		Weather.		Remarks.
	Dry Bulb.	Wet Bulb.	Max.	Min.		Direction.	Anemometer. Total in Day.	At 9 a.m.	In previous 24 Hours.	
					Inches.		Miles.			
1892 December 9	37	35	37	27		N.E.	90	C.	Snow.	
" 10	28	28	41	25	·20	S.W.	75	C.	Cloudy.	
" 11	39	39	45	25	·10	N.W.	265	C.	"	
" 12	41	40	45	37	·15	W.	355	C.	"	
" 13	35	34	47	34	·10	S.W.	150	C.	"	
" 14	47	46	52	33	·04	S.E.	50	C.	"	
" 15	45	45	53	43		S.E.	50	F.	Fine.	
" 16	35	35	50	31	·02	S.W.	150	C.	Cloudy.	
" 17	49	49	54	34		S.E.	310	C.	"	
" 18	50	50	54	46		N.E.	230	F.	Fine.	
" 19	46	46	49	46		S.E.	250	F.	"	
" 20	44	43	47	42		S.E.	50	F.	"	
" 21	44	42	46	41		S.E.	30	F.	"	
" 22	37	37	44	34		N.E.	50	F.	"	
" 23	36	36	39	30		N.E.	90	C.	Cloudy.	
" 24	31	31	34	30		S.E.	150	F.	Fine.	
" 25	27	26	31	24		S.E.	100	F.	"	
" 26	13	13	32	16		N.E.	60	F.	"	
" 27	16	16	30	12		S.E.	10	F.	"	
" 28	15	15	31	12		S.E.	20	F.	Foggy.	
" 29	26	26	32	13		N.E.	10	F.	"	
" 30	25	25	35	18		N.E.	20	F.	"	
" 31	35	35	31	24		N.E.	100	F.	"	
1893, January 1	32	27	31	25		N.E.	30	F.	Fine.	
" 2	25	25	34	19		N.E.	50	C.	Cloudy.	
" 3	35	35	34	20		S.E.	20	C.	"	
" 4	19	19	22	14		E.	50	F.	Foggy.	
" 5	19	18	31	9		E.	110	F.	"	
" 6	29	29	34	17		S.E.	20	C.	Cloudy.	
" 7	31	31	37	28		S.E.	100	C.	"	
" 8	35	35	37	29	·12	S.E.	100	C.	"	
" 9	37	36	37	32		S.E.	75	C.	"	
" 10	35	35	39	31		N.	100	C.	"	
" 11	35	35	38	29		N.	300	F.	Fine.	
" 12	35	35	38	32		N.E.	25	F.	"	
" 13	35	35	41	32	·10	N.W.	105	F.	"	
" 14	35	35	35	30		S.E.	300	F.	"	
" 15	30	30	37	28		S.W.	480	F.	"	
" 16	35	35	41	27	·40	S.W.	50	C.	Cloudy.	
" 17	35	35	44	33	·12	S.E.	100	C.	"	
" 18	44	44	47	34		N.W.	330	C.	"	
" 19	41	40	46	34	·40	S.E.	100	C.	"	
" 20	37	37	43	32	·50	S.W.	130	F.	Fine.	
" 21	40	40	44	36	·04	N.W.	125	F.	"	
" 22	43	43	46	30	·20	N.W.	100	C.	Cloudy.	
" 23	45	45	49	32	·20	N.W.	175	C.	"	
" 24	45	45	52	44		N.W.	225	F.	Fine.	
" 25	40	39	50	37	..	S.W.	475	F.	"	
" 26	46	44	47	35	·15	S.W.	450	C.	Cloudy.	
" 27	36	35	46	31		S.W.	275	F.	Fine.	
" 28	38	36	57	34	·10	S.E.	200	F.	"	
" 29	46	45	50	36		S.E.	150	C.	Cloudy.	
" 30	46	44	52	40	·40	S.W.	250	F.	Fine.	
" 31	49	45	52	45	·12	S.W.	75	F.	"	

TABLE LVIII.—*continued.*

Date.		Hygrometer.		Temperature.		Rain.	Wind.		Weather.		Remarks.
		Dry Bulb.	Wet Bulb.	Max.	Min.		Direction.	Anemometer. Total in Day.	At 9 a.m.	In previous 24 hours	
						Inches.		Miles.			
1893, February	1	37	36	46	45	·20	N.	135	C.	Cloudy.	
„	2	41	40	44	35	·18	N.W.	200	C.	„	
„	3	43	42	51	40		N.E.	125	F.	Fine.	
„	4	45	44	47	41		S.W.	100	F.	„	
„	5	35	33	40	32		S.W.	50	F.	„	
„	6	33	32	48	30		S.E.	75	F.	„	
„	7	45	43	51	32	·5	S.E.	100	F.	„	
„	8	42	40	45	40	·2	W.	85	F.	„	
„	9	44	42	47	38	·22	N.W.	25	C.	Cloudy.	
„	10	47	45	51	40	·10	N.W.	750	C.	„	
„	11	45	41	45	43	·15	N.W.	450	F.	Fine.	
„	12	37	36	42	35	·5	N.W.	650	C.	Cloudy.	
„	13	36	35	48	34	·30	S.W.	570	C.	„	
„	14	47	46	53	35	·5	S.W.	80	C.	„	
„	15	43	41	51	35	·4	S.W.	100	C.	„	
„	16	47	45	49	42	·20	S.W.	175	C.	„	
„	17	36	35	51	34	·10	S.W.	150	F.	Fine.	Thunder and lightning.
„	18	51	49	54	35	·4	S.W.	100	F.	„	
„	19	51	49	48	46	·2	S.W.	50	C.	Cloudy.	
„	20	40	39	49	38	·2	S.W.	25	F.	Fine.	
„	21	40	37	42	87	·5	S.W.	150	F.	„	
„	22	40	37	40	37	·4	N.E.	75	C.	Cloudy.	
„	23	35	34	39	34		N.E.	100	F.	Fine.	
„	24	31	31	34	29		N.W.	460	F.	„	
„	25	32	32	39	29	·35	N.W.	150	C.	Snow.	Snow.
„	26	39	37	42	29	·12	S.E.	200	C.	Cloudy.	
„	27	36	34	42	32		S.E.	205	F.	Fine.	
„	28	27	27	42	25			50	C.	Cloudy.	
1893, March	1	27	27	54	25	·12	S.E.	5	F.	Fine.	
„	2	48	46	53	37	·10	N.W.	0	C.	„	
„	3	42	40	50	40	·08	S.E.	100	C.	Cloudy.	
„	4	48	47	51	40	·04	N.W.	300	C.	„	
„	5	49	48	52	44		S.W.	440	C.	„	
„	6	45	44	49	43	·04	S.W.	100	C.	Fine.	
„	7	45	44	50	39	·02	S.W.	260	C.	„	
„	8	40	39	51	40		N.W.	125	C.	„	
„	9	44	42	51	40		S.W.	100	C.	„	
„	10	42	40	45	40		N.W.	400	F.	„	
„	11	39	38	56	37		S.W.	200	F.	„	
„	12	40	36	67	30		S.E.	300	F.	„	
„	13	46	45	52	39		S.W.	208	F.	„	
„	14	42	41	51	39		S.W.	100	F.	„	
„	15	47	46	53	41	·09	S.W.	25	F.	Cloudy.	
„	16	42	41	45	40		S.W.	100	C.	„	Hail and snow.
„	17	34	35	43	34	·06	N.W.	250	C.	„	Ditto.
„	18	35	32	42	30		N.W.	770	F.	Fine.	
„	19	31	29	48	24		E.	130	F.	„	
„	20	37	36	52	30		N.E.	100	F.	„	
„	21	35	34	62	30		S.E.	100	F.	„	
„	22	35	35	61	33		N.E.	200	F.	„	
„	23	40	39	65	32		E.	25	F.	„	
„	24	36	35	66	34		S.E.	100	F.	„	
„	25	52	50	66	35		S.E.	60	F.	„	
„	26	38	37	64	31		S.E.	25	F.	„	
„	27	45	45	54	36		S.E.	100	F.	„	

TABLE LVIII.—*continued.*

Date.		Hygrometer.		Temperature.		Rain.	Wind.		Weather.		Remarks.
		Dry Bulb.	Wet Bulb.	Max.	Min.		Direction.	Anemometer. Total in Day	At 9 a.m.	In previous 24 hours.	
						Inches.		Miles.			
1893, March	28	38	37	62	34		S.E.	60	F.	Fine.	
„	29	34	34	65	32		N.E.	100	F.	„	
„	30	42	42	61	33		S.E.	55	F.	„	
„	31	45	44	65	39		S.W.	25	F.	„	

TABLE LIX.

(Referred to on p. 22 *ante.*)

Showing the number of Houses in which one, and more than one case, respectively, arose.

	318	houses in which 1 case of small-pox arose - - -	= 318 cases.
	75	houses in which 2 cases of small-pox arose - - -	= 150 cases.
	31	houses in which 3 cases of small-pox arose - - -	= 93 cases.
	8	houses in which 4 cases of small-pox arose - - -	= 32 cases.
	5	houses in which 5 cases of small-pox arose - - -	= 25 cases.
	20	houses in which the vaccinated condition of the other inmates was not obtainable (see page 22 *ante*) - - - - -	= 49 cases.
Totals	457	houses containing - - - - - - - -	667 cases.

THOMAS D. SAVILL, M.D. Lond., D.P.H. Camb.

February, 1894.

MAP I.

THE BOROUGH OF WARRIN

FROM THE BOROUGH SURVEY 18
BY T. LONGDIN, BOROUGH SURVEYO
Corrected to date 1893.

Explanation of certain letters on the

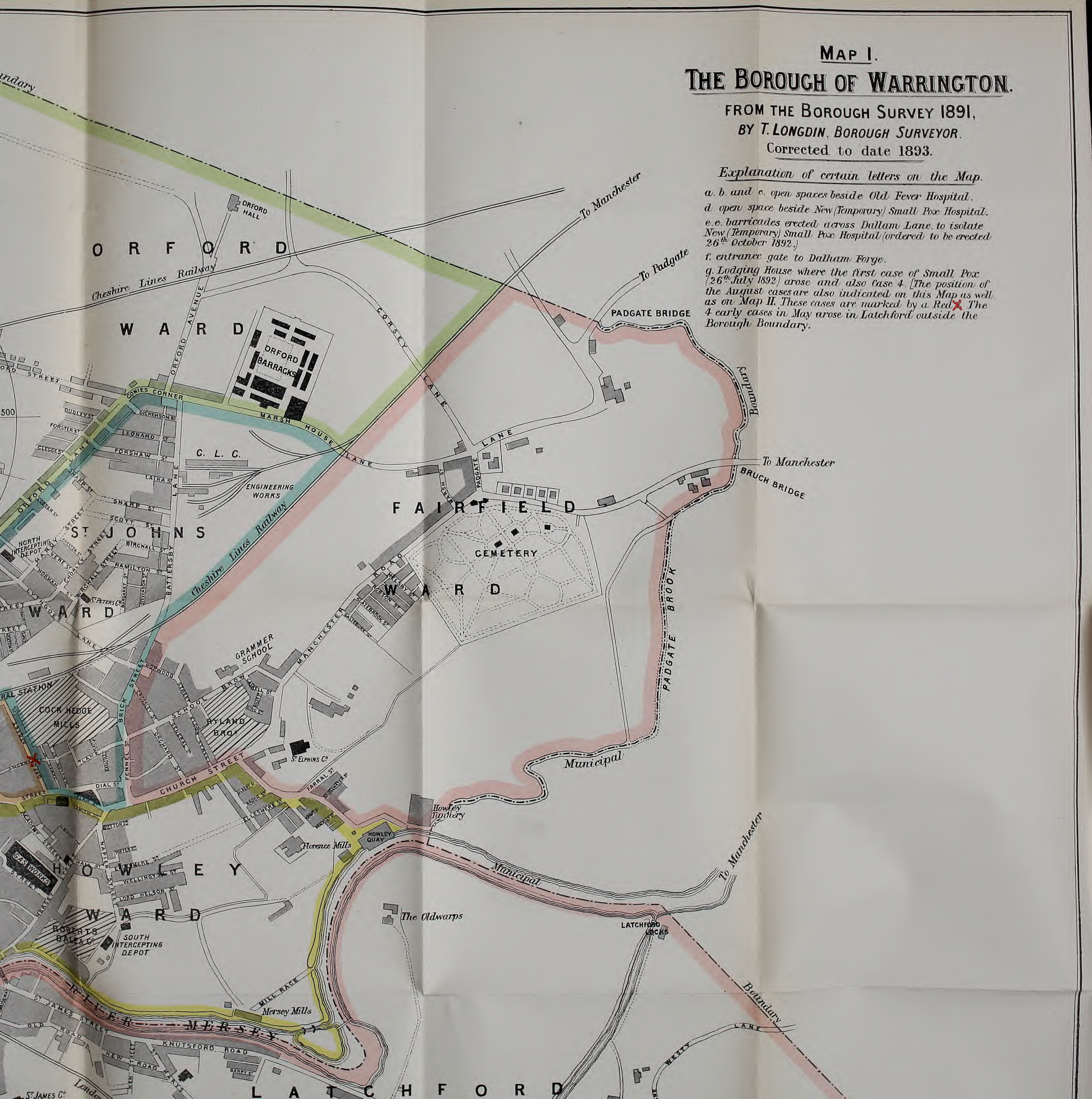
a. b. and c. open spaces beside Old Fever Hosp

d. open space beside New (Temporary) Small Pox H

e. e. barricades erected across Dallam Lane, to New (Temporary) Small Pox Hospital (ordered to be 26th October 1892.)

f. entrance gate to Dalham Forge.

g. Lodging House where the first case of Small (26th July 1892) arose and also Case 4. [The pos the August cases are also indicated on this Ma as on Map II. These cases are marked by a Red 4 early cases in May arose in Latchford outsid Borough Boundary.



MAP I.

THE BOROUGH OF WARRINGTON.

FROM THE BOROUGH SURVEY 1891,
BY T. LONGDIN, BOROUGH SURVEYOR.
Corrected to date 1893.

Explanation of certain letters on the Map.

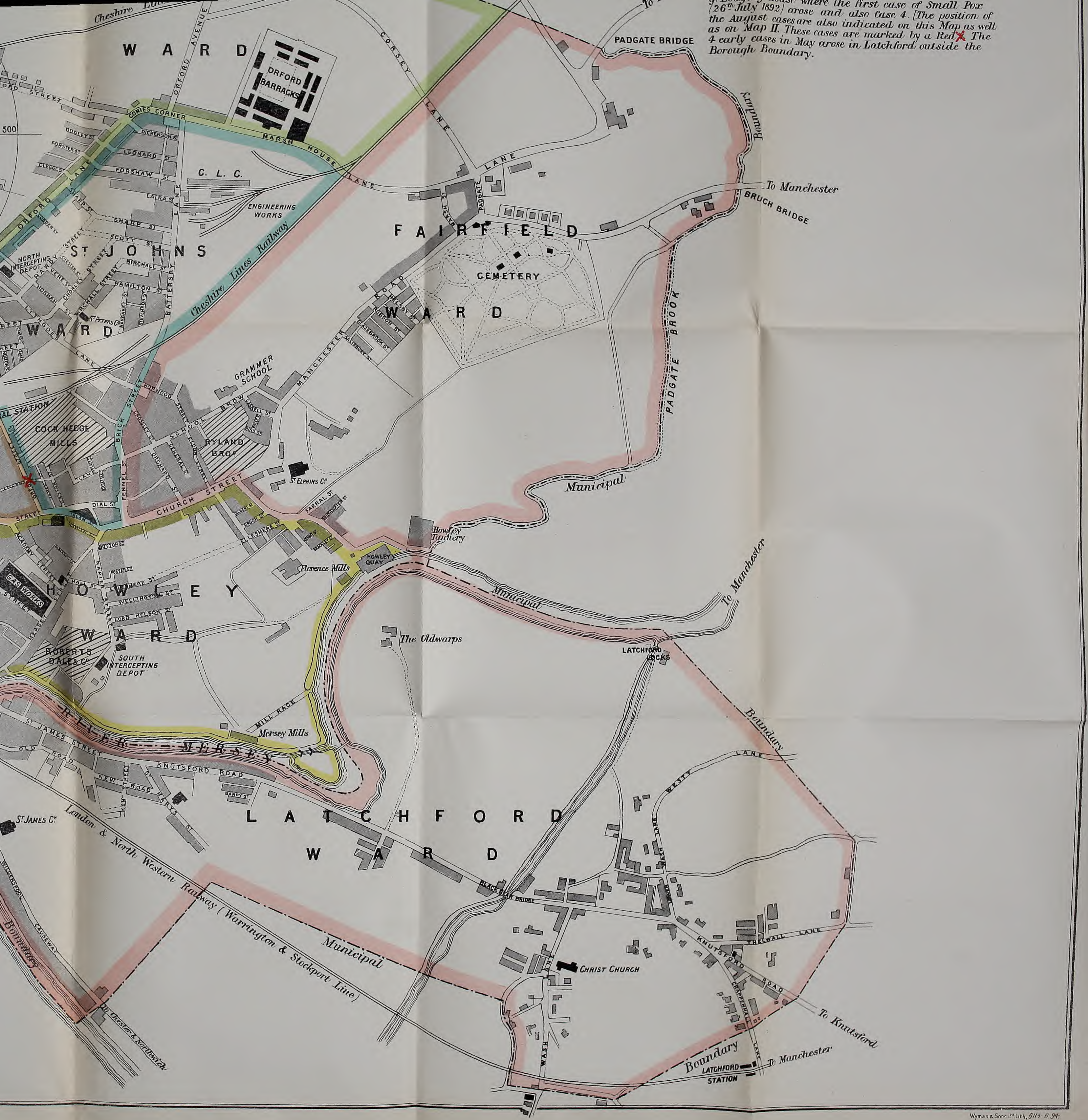
a. b. and c. open spaces beside Old Fever Hospital.

d. open space beside New (Temporary) Small Pox Hospital.

e. e. barricades erected across Dallam Lane, to isolate New (Temporary) Small Pox Hospital (ordered to be erected 26th October 1892.)

f. entrance gate to Dalham Forge.

g. Lodging House where the first case of Small Pox (26th July 1892) arose and also Case 4. [The position of the August cases are also indicated on this Map as well as on Map II. These cases are marked by a Red ✕ The 4 early cases in May arose in Latchford outside the Borough Boundary.



where the first case of Small Pox (26th July 1892) arose and also Case 4. [The position of the August cases are also indicated on this Map as well as on Map II. These cases are marked by a Red ✗ The 4 early cases in May arose in Latchford outside the Borough Boundary.

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SANKEY
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BATHS
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RYLAND BROS
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MANCHESTER ROAD
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St JAMES Ch
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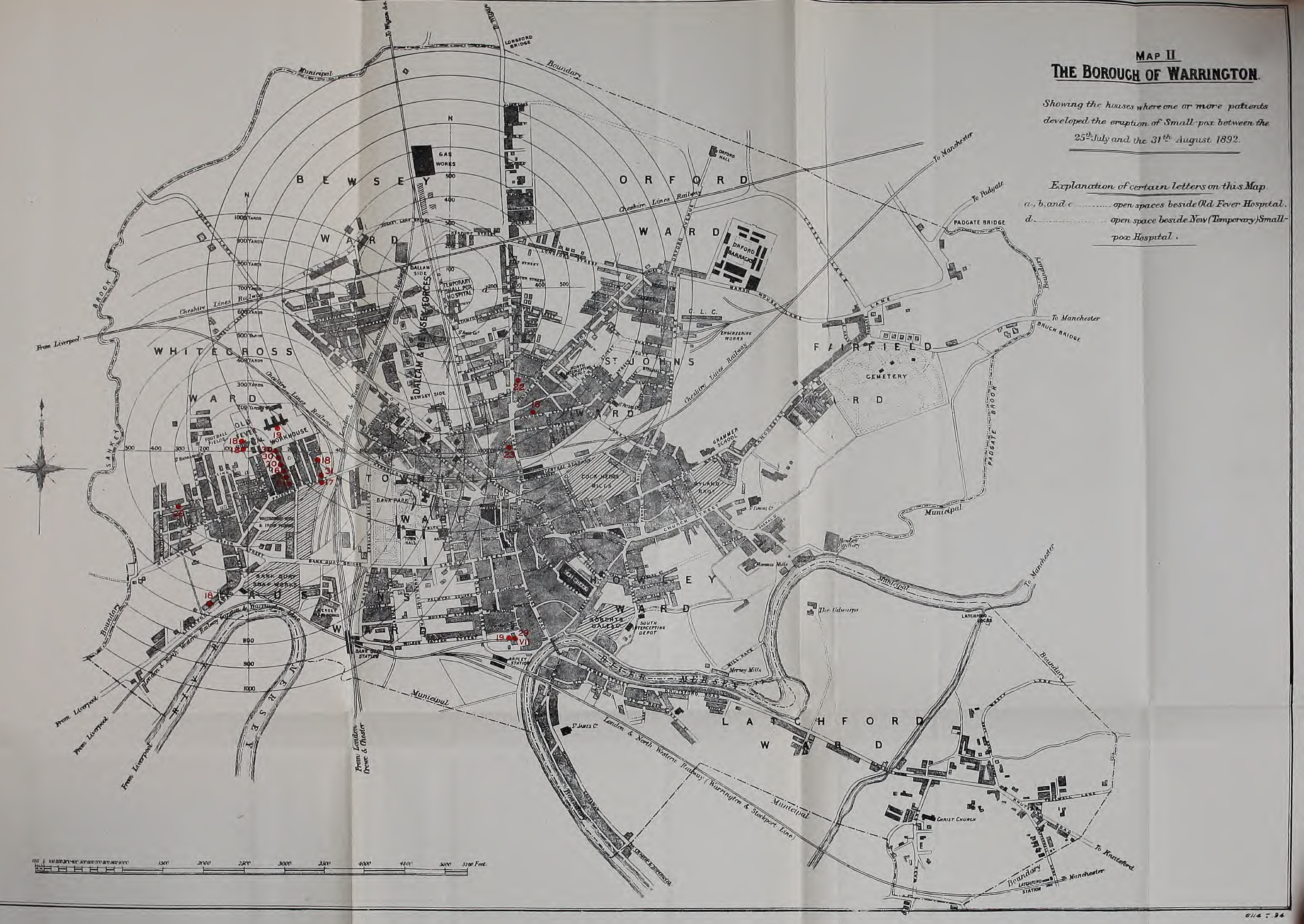

MAP II
THE BOROUGH OF WARRINGTON.

Showing the houses where one or more patients developed the eruption of Small-pox between the 25th July and the 31th August 1892.

Explanation of certain letters on this Map.

a, b, and c .... open spaces beside Old Fever Hospital.

d. .... open space beside New (Temporary) Small-pox Hospital.

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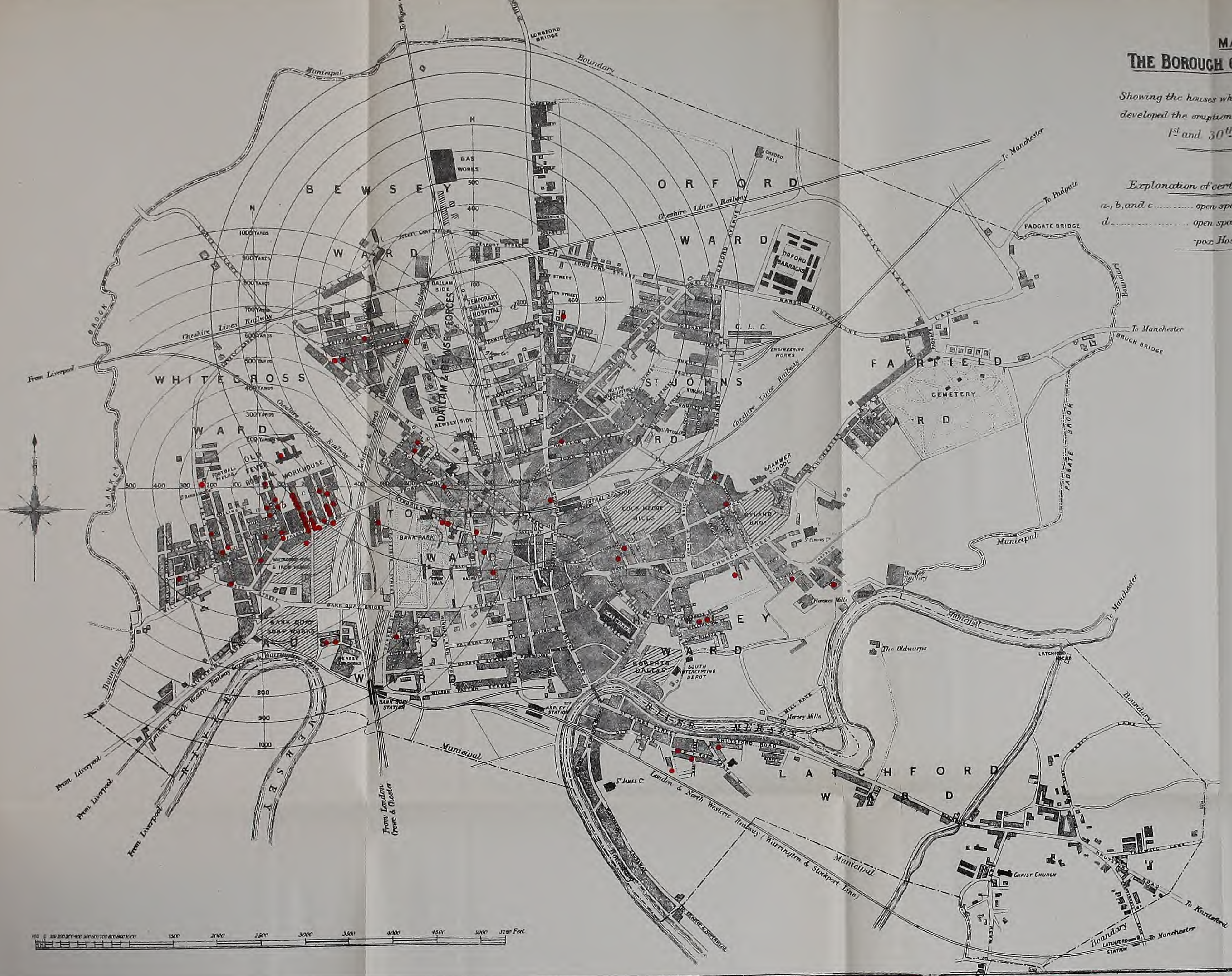

Map III.

The Borough of Warrington.

Showing the houses where one or more patients developed the eruption of Small-pox between the 1st and 30th September 1892.

Explanation of certain letters on this Map.

a, b, and c ………… open spaces beside Old Fever Hospital.
d ………………… open space beside New (Temporary) Small-pox Hospital.

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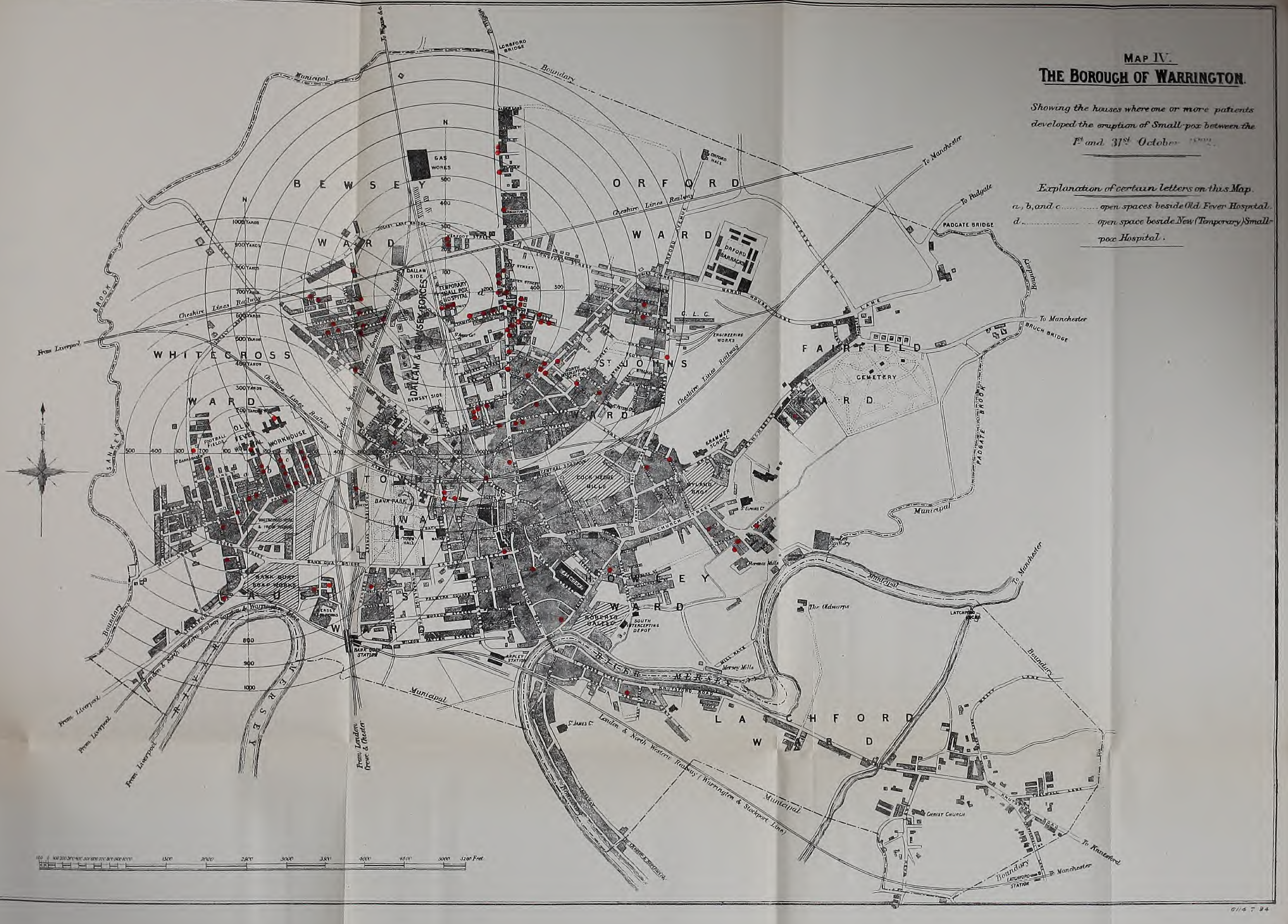


MAP IV.

THE BOROUGH OF WARRINGTON.

Showing the houses where one or more patients developed the eruption of Small-pox between the 1st and 31st October 1892.

Explanation of certain letters on this Map.

a, b, and c	*open spaces beside Old Fever Hospital.*
d	*open space beside New (Temporary) Small-pox Hospital.*

6114 7 94

Face page 100.

MAP V

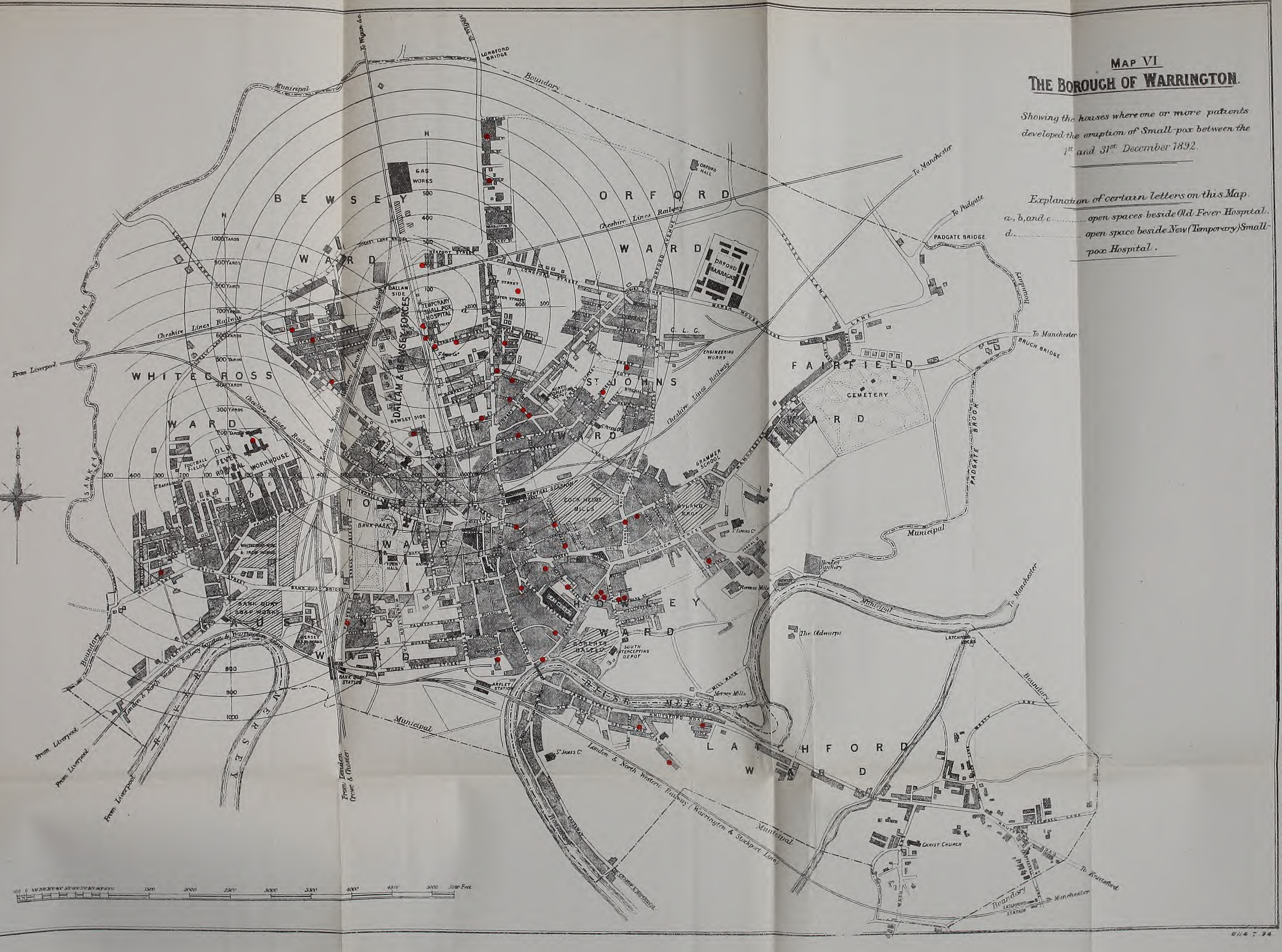
THE BOROUGH OF WARRINGTON.

Showing the houses where one or more patients developed the eruption of Small-pox between the 1st and 30th November 1892

Explanation of certain letters on this Map.

a, b, and c .... *open spaces beside Old Fever Hospital.*

d .... *open space beside New (Temporary) Small-pox Hospital.*



MAP VI

THE BOROUGH OF WARRINGTON.

Showing the houses where one or more patients developed the eruption of Small-pox between the 1st and 31st December 1892.

Explanation of certain letters on this Map.

a, b, and c ………… *open spaces beside Old Fever Hospital.*
d ………… *open space beside New (Temporary) Small-pox Hospital.*

Map VII.

The Borough of Warrington.

Showing the houses where one or more patients developed the eruption of Small-pox between the 1st and 31st January 1893.

Explanation of certain letters on this Map.

a, b, and c .... *open spaces beside Old Fever Hospital.*

d. .... *open space beside New (Temporary) Small-pox Hospital.*

MAP VIII.

THE BOROUGH OF WARRINGTON.

Showing the houses where one or more patients developed the eruption of Small-pox between the 1st and 28th February 1893.

Explanation of certain letters on this Map.

a, b, and c .... *open spaces beside Old Fever Hospital.*
d .... *open space beside New (Temporary) Small-pox Hospital.*

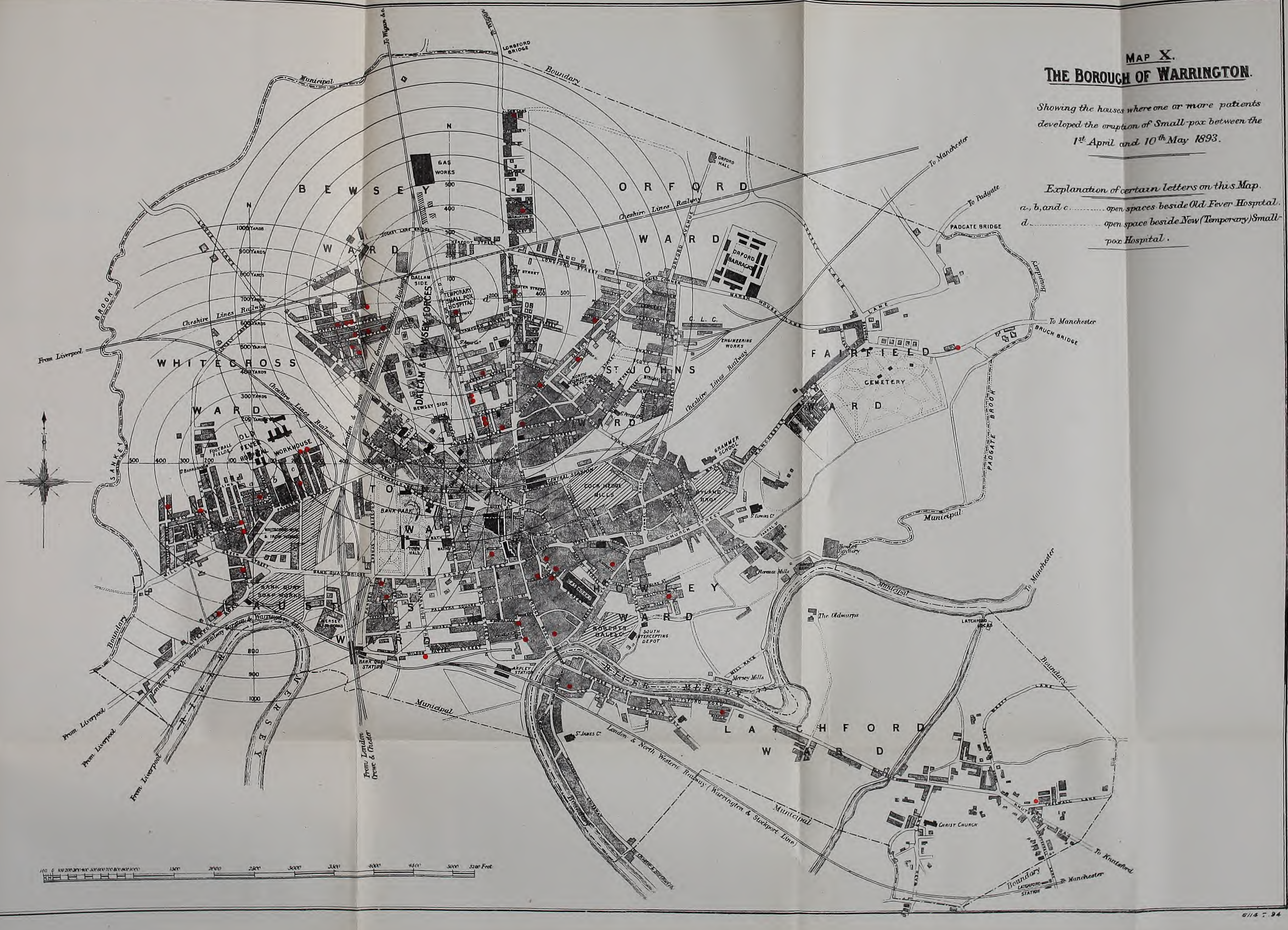
MAP IX.

THE BOROUGH OF WARRINGTON.

Showing the houses where one or more patients developed the eruption of Small-pox between the 1st and 31st March 1893.

Explanation of certain letters on this Map.

a, b, and c	*open spaces beside Old Fever Hospital.*
d	*open space beside New (Temporary) Small-pox Hospital.*



MAP X.

THE BOROUGH OF WARRINGTON.

Showing the houses where one or more patients developed the eruption of Small-pox between the 1st April and 10th May 1893.

Explanation of certain letters on this Map.

a, b, and c .... *open spaces beside Old Fever Hospital.*

d .... *open space beside New (Temporary) Small-pox Hospital.*

VACCINATION COMMISSION.

APPENDIX VI.

TO THE

FINAL REPORT

OF THE

ROYAL COMMISSION ON VACCINATION.

REPORT TO THE COMMISSION OF

DR. SIDNEY COUPLAND

ON THE

OUTBREAK OF SMALL-POX IN THE BOROUGH OF LEICESTER IN 1892-3.

Presented to both Houses of Parliament by Command of Her Majesty.

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Report on the Outbreak of Small-pox at Leicester, in 1892-3.

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INTRODUCTION.

Object of inquiry.

In pursuance of instructions from the chairman of the Royal Commission on Vaccination I visited Leicester on November 11th, 1892, to gain information concerning the appearance and spread of small-pox in that town, and in particular to ascertain the precise methods in force to deal with it. I was courteously received by the Sanitary Committee then sitting, and had an opportunity of learning from its chairman (Ald. Windley) the measures which had of late years been in operation for coping with this disease. Dr. Priestley, the Medical Officer of Health, kindly accompanied me to the Infectious Diseases Hospital and gave me particulars of the origin of the cases of small-pox which were then in the wards. Up to that time there were known to have occurred in the town 20 cases of small-pox, and the practice of prompt isolation on receipt of notification, not only of the patient, but of the persons known to have been in the company of the former had been carried out ; the small-pox case being taken to a detached wing of the hospital, and the rest lodged in quarantine in another part of the building. When the small-pox first appeared, scarlet fever was very prevalent in the borough, and the hospital was crowded with children in all stages of that disease. It is not surprising therefore that, in spite of precautions, small-pox attacked some of these fever patients, and six of these patients are included in the number of those who had been attacked up to that time, whilst two others were attendants employed at the hospital. At the time of my visit the wards had been cleared of scarlet fever, and from that date forward the whole hospital was given up to the reception of cases of small-pox and quarantined persons.

Period of inquiry.

I continued to visit Leicester periodically during the following year, and was thereby enabled to follow the progress of the epidemic, and to see personally nearly every case of small-pox admitted into hospital. The report which I now submit contains the information thus obtained. This report covers a period of 70 weeks, commencing from the week ending August 27th, 1892, to the week ending December 23rd, 1893. It will be seen that within this period one or more fresh cases arose in Leicester in each of the weeks except five, but that in no week did the number exceed 21, the average being five attacks per week. Of the total—357 cases, there were 12 which did not come to the knowledge of the Sanitary Authority until the occurrence of other cases subsequent to them. These cases had either not been visited by medical men, or had escaped notification, the mildness of their type causing them to be unrecognised at the time. The first case of all (W. S.) falls into this category.

Number of small-pox cases.

Hospital infection.

Besides the infection of the inmates of the fever ward in the early weeks of the outbreak, already alluded to, it is noteworthy that during a subsequent period there was a disproportionate incidence of small-pox upon the inhabitants of Newfound Pool, an outlying part of the borough, in the vicinity of the hospital. The thorough investigation made by Dr. Priestley into the origin of these cases points strongly to aërial infection of the locality from the small-pox wards. If this be so, it leads to the conclusion that more than one-fifth (viz. 77) of the whole number of cases received their infection directly or indirectly from the hospital. For of those known to have been infected at the building there were 19, viz. 13 children admitted for scarlet fever and 6 attendants or nurses who were attacked at various dates.* Three cases were infected from these ; whilst 55 occurred in the Newfound Pool district.

It is to be regretted that the proposal to erect new buildings upon another site for the accommodation of small-pox patients was not carried out.

Quarantine.

A point of especial interest in regard to the method of dealing with small-pox at Leicester is the system of quarantine of infected families, a plan which had been in use for some years, and was being carried out when I first visited the town. It seemed to me that in the adoption of this practice Leicester might claim to be distinctive, although to a large extent a like system has also been introduced at Glasgow, Leeds, and elsewhere. In other respects—notification, isolation of patients, house disinfection—the practices were similar to those in vogue in other places. Indeed, theoretically, such a system of quarantine—if carried out in its entirety—would seem to be especially applicable to the arrest of small-pox outbreaks, owing (1) to the definite period of incubation of the disease, and (2) to its infectivity prior to the appearance on the patient of a distinctive rash. Therefore a quarantine extending over 16 days from the removal of the patient would cover the period at which any case amongst those exposed to infection would be likely to arise; whilst the strict supervision of persons who have thus been exposed would enable steps to be at once taken to isolate any quarantined person who presented symptoms of illness. In practice the perfect adoption of this plan necessitates the provision of accommodation extensive enough to lodge the members of several families, besides requiring the willing co-operation of all concerned. For although its adoption ought to prevent an outbreak of small-pox from assuming epidemic proportions, yet when the disease is prevalent in all parts of the country, the liability of a town of the size of Leicester to receive fresh importations is very great. Indeed, it will be seen that many cases were thus imported during the present outbreak. Where the accommodation is insufficient, and especially where, as in this instance, the provision for quarantining is a building that practically forms part of the infectious hospital, there is not only an impossibility of fully carrying out the practice, but a risk lest the very measure intended to protect the community from further invasion, might really be the means of promoting this. It is not, therefore, to be wondered at that the Sanitary Authority was led to abandon this essential feature of the plan known as the "Leicester system," and to substitute for it the generally adopted practice of maintaining infected families under supervision in their houses during the "quarantine period" of 16 days. Nor was this "home-quarantine," as it has been termed, as rigid as is sometimes attempted. The inmates of the houses were permitted and were even encouraged to go out daily, provided they did not mingle with other folk, and in some cases were allowed to continue at their work. This change in practice would, it might be thought, have given an opportunity of estimating the value of the strict quarantine system by affording a comparison between the two methods. The difficulties in arriving at any conclusions are, however, insuperable, for they demand a fuller knowledge of the genesis of every case than it is possible to obtain. The general impression left on my mind is that where the cases of small-pox were early notified, the one method is as efficacious as the other in limiting the spread of infection from house to house. So far as the subject can be dealt with statistically, I have attempted it in this report.

---

* To these cases of hospital infection there should perhaps be added the following :—No. 116, W. R., a plumber, at work in the building 14 days before sickening ; No. 155, W. H., apparently infected in quarantine ; No. 160, F. W., who came to meet her sister on her discharge from hospital ; No. 295, C. P., known to have been in close vicinity of hospital a fortnight before attack. Another case, No. 295, M. B., was infected by visiting an infected house in Newfound Pool (*see* Table of Cases). The inclusion of these cases would bring the total attributable to hospital infection up to 82. I find that Dr. Priestley adds some others dwelling "within the hospital area" at the north end of the town—making a total of 85. (*See* Report, Medical Officer of Health, 1893, p. 133.)

Comparative incidence on the unvaccinated.

Another matter upon which the experience of an epidemic of small-pox in Leicester is of value, is that which forms the main object of this inquiry. In a community of which the child-population is largely unvaccinated, the occurrence of small-pox may be expected to throw some light upon the degree and extent of the influence of vaccination upon (1) the liability to attack, (2) the severity of attack, and (3) the mortality from the disease. On these points it may be remarked that the incidence, severity, and fatality in this outbreak were disproportionately high amongst children, even after deducting those who were directly infected at the hospital. The analysis of the vaccination conditions of the members of 193 invaded households, which has been attempted in this report, would seem to show that in this epidemic, at least, the natural liability to small-pox, unaffected by vaccination, was not so great as has been supposed. Thus of the 1,234 persons in this community, 33 were under 1 year of age, 328 aged 1 to 10 years, 534 aged 10 to 30 years, 330 aged 30 years and upwards, and of 9 the age is not mentioned. It will be seen in the text that of those under 1 year—the unvaccinated form 91 per cent.—the small-pox attacks 21·2 per cent. (85·6 per cent. unvaccinated); of those aged 1 to 10 years—the unvaccinated form 74 per cent.—the small-pox attacks 28·9 per cent. (95·8 per cent. of those attacked being unvaccinated); of those aged 10 to 30 years—the unvaccinated form 15·5 per cent.—the small-pox attacks 28·1 per cent. (29·3 per cent. of those attacked being unvaccinated); of those aged 30 years and over—the unvaccinated form 2·7 per cent.—the small-pox attacks 20·5 per cent. (5·8 per cent. of those attacked being unvaccinated).

Having recently reported to the Royal Commission upon the outbreak of small-pox in the Dewsbury Union in 1891–92, I have thought that it might be instructive to contrast the main statistical results obtained in that inquiry with those gathered at Leicester. I have, therefore, compiled a few tables which form a supplementary note to the present report, whereby this comparison can be readily made. I may here premise that, except for the visitation of small-pox, there are but few points of similarity between these two centres. On the one hand, we have in Leicester a large Midland town with a population (in 1891) of upwards of 177,000 inhabitants, with a well-organised municipal government and thoroughly equipped sanitary organisation; whilst on the other there is in the Dewsbury Union a population of over 160,000 dwelling on an area three times as extensive as that of Leicester, and composed of 14 urban sanitary districts each with its separate sanitary officials. Again, in Leicester, notification of infectious disease has long prevailed, and is thoroughly enforced; in the Dewsbury Union, at the time of the small-pox outbreak, it had either been only recently carried into effect or had not then been adopted. Lastly, the provision for isolation of infectious diseases—which, although inadequate in Leicester, yet sufficed to accommodate all the cases of small-pox—in the Dewsbury Union was such that only about two thirds of the cases had hospital isolation. The time over which the inquiry extended was the same in each, viz., 70 weeks, and the number of cases of small-pox during this period in 1892–93, in Leicester, was 357, whilst in the Dewsbury Union, in 1891–92, it amounted to 1,029. The death-rate amongst these cases was 5·8 per cent. in Leicester, 10·7 per cent. in the Dewsbury Union. But as regards the relative severity of attacks—apart from their fatality—there will be seen to be a close parallelism in the two series. Thus, in Leicester, the confluent (and malignant) type of small-pox form 26·8 per cent. of the whole number; in the Dewsbury Union, 26·5 per cent.; the coherent type was met with in 15·6 per cent. in Leicester, in 12·1 per cent. in the Dewsbury Union; the discrete type in 21·8 per cent. in Leicester, and 32·3 per cent. in the Dewsbury Union; and of the mild or varioloid type there were 35·5 per cent. in Leicester, and 27·5 per cent. in the Dewsbury Union.

It will, however, be seen that the incidence of the disease was greater upon children over one year of age in Leicester than in the Dewsbury Union. Thus, the proportion of infants under one year of age who were attacked was 1·9 per cent. of those attacked at all ages in Leicester; 2·8 per cent. in Dewsbury Union; but of those aged between 1 and 10 years the proportions were: Leicester, 28·5 per cent.; Dewsbury Union, 18·9 per cent. (or between ages 1 and 15 years, Leicester, 38·9 per cent.; Dewsbury Union, 29·4 per cent.). The proportion of those aged 10 to 30 years was 45·1 per cent. for Leicester, 54·4 per cent. for the Dewsbury Union, whilst the two series were nearly equal for the periods 30 years and upwards, viz., 24·3 per cent. for Leicester, 23·1 per cent. for the Dewsbury Union.

Although in consequence of the larger number attacked and the smaller total of deaths, the comparative mortality of those aged 1 to 10 years was less at Leicester (12·7 per cent.) than in the Dewsbury Union (19·4 per cent.), yet, relatively to the whole number of deaths from small-pox, 61·9 per cent. at Leicester occurred in subjects of this age-period, as compared with 34·5 per cent. in the Dewsbury Union.

The proportion of unvaccinated amongst those attacked with small-pox was higher in Leicester (viz., 43·1 per cent.) than in the Dewsbury Union (33·6 per cent.); but on the other hand the statistics of 193 households invaded by small-pox in Leicester show a proportion of 24·4 per cent. of unvaccinated amongst the members of these households who escaped attack; but in 544 such households in the Dewsbury Union the proportion was only 11 per cent. These returns enable one to calculate that in Leicester 39·4 per cent. of the unvaccinated indwellers of invaded houses were attacked with small-pox; in the Dewsbury Union, 55·7 per cent.

It will further be seen that in Leicester, 96·1 per cent. of those attacked between the ages of 1 and 10 years were unvaccinated; in the Dewsbury Union, 70·2 per cent.

It does not appear from these figures that the disproportion, in the extent of the disease in the two areas compared was due to spread of infection within households; for it is remarkable that the proportion of houses (*i.e.*, of those in which particulars of the inmates were obtained) yielding single cases of small-pox is almost the same; it was 65·8 per cent. in Leicester and 65·2 per cent. in the Dewsbury Union. This concordance is the more surprising since, not only was hospital isolation much more generally carried out in Leicester, but with far greater promptitude on the whole. The difference between the two outbreaks is mainly that of diffusion, and so far as it is permitted for an outside observer to judge, it might be said that the limitation of the spread of small-pox in Leicester was due, amongst other factors, to the readiness with which the cases were dealt with by the Sanitary Authority, through the energetic action of the medical officer and his staff.

In conclusion, I beg to offer my sincere thanks to the Medical Officer of Health, Dr. Priestley, for his invariable courtesy and the kindness with which he placed his time and information at my disposal. I have also to thank the chief sanitary inspector, Mr. Braley, for his assistance, and the chairman and members of the sanitary committee for the facilities afforded me in conducting the inquiry.

Report on the Outbreak of Small-pox at Leicester in 1892–93.

§1. *Population; Birth Rate; Death Rate.*

The population of Leicester at the census of 1891 was 177,353, and the estimated population for 1893 was 184,547. It should be stated, however, that in October 1891, the borough was enlarged by the addition of nine districts comprising an area of 5,504 acres (with an estimated population 38,680). By this extension of boundaries, the area of the borough was more than doubled, viz.:—from 3,030 to 8,534 acres. The density of the population in 1893 was therefore 21·6 persons per acre; in 1890, prior to the extension, it was "50 persons per acre"; but in parts "more than double this."

The annual birth-rate per 1000 of total population during each of the 19 years 1875 to 1893, has ranged between 42·09 in 1876, to 30·43 in 1890. In 1893 it was 32·5.

The annual death-rate during the same period has ranged between 26·02 in 1875, to 16·68 in 1889. In 1893 it was 19·6.

The infantile mortality is high. In these years the proportion per 1,000 deaths at all ages of those dying under one year of age has varied from 399·5 in 1889 to 331·1 in 1879. In 1893 this proportion was 365·04. The proportion of those dying under the age of five years has been as high as 581·6 in 1880, and as low as 451·2 in 1890. This proportion in 1893 was 487·4.

[*See* Table I., compiled from the Annual Reports of Medical Officer of Health, which abound in valuable statistics.]

TABLE I.

LEICESTER—POPULATION, BIRTHS and DEATHS (from REPORTS of MEDICAL OFFICER OF HEALTH).

—	Estimated Population.	Births.		Deaths.		Deaths under one Year per of 1,000 Total Deaths.	Deaths under 5 years per 1,000 of Total Deaths.	Deaths in Public Institutions.	
		Total.	Per 1,000 of Population.	Total.	Per 1,000 of Population.			Total.	Per 1,000 of Total Deaths.
1875 - -	111,000	4,260	38·37	2,889	26·02	356·8	554·8	—	—
1876 - -	113,581	4,781	42·09	2,558	22·52	373·7	547·3	—	—
1877 - -	117,462	4,753	40·46	2,515	21·41	356·6	498·6	—	—
1878 - -	119,845	4,779	39·87	2,500	20·72	392·4	548·0	—	—
1879 - -	117,610	4,887	37·31	2,651	21·1	331·0	331·1	—	—
1880 - -	120,325	4,860	40·39	2,960	24·7	360·3	581·6	—	—
1881 - -	123,120	4,711	38·26	2,654	21·56	363·2	517·7	—	—
1882 - -	126,275	4,855	38·44	2,528	20·05	372·6	513·1	—	—
1883 - -	129,483	4,823	37·34	2,484	19·18	367·5	511·6	—	—
1884 - -	132,773	4,851	36·53	2,937	22·12	381·6	543·9	—	—
1885 - -	136,147	4,682	34·38	2,641	19·39	343·4	513·8	—	—
1886 - -	139,606	4,858	34·8	2,738	19·61	384·2	505·1	265	96·7
1887 - -	143,153	4,689	32·75	2,722	19·01	371·7	516·9	306	112·4
1888 - -	146,790	4,787	32·61	2,640	17·98	371·2	505·7	310	121·4
1889 - -	150,520	4,789	31·81	2,513	16·68	399·5	507·7	270	107·4
1890 - -	154,344	4,699	30·43	2,799	17·79	342·2	451·2	271	96·7
1891 - -	177,353	4,790	33·58	3,026	21·21	346·3	511·1	230	95·3
1892 - -	180,066	5,816	32·2	3,250	18·04	353·8	510·1	393	120·9
1893 - -	184,547	6,006	32·5	3,627	19·6	365·04	487·4	450	124·06

§2. *Zymotic Disease.*

In the accompanying series of Tables which I have prepared from the Annual Reports of the Medical Officers of Health, the mortality from zymotic diseases in Leicester since 1875 is given.

It will be seen (Table II.) that the comparative zymotic mortality has fluctuated during these years from a minimum of 98·2 per 1,000 of the total deaths from all causes in 1889, to a maximum of 263·1 in 1880, the years of greatest zymotic mortality being in order—1880, 1875, 1876, 1881, 1878, and those of lowest such mortality—1889, 1890, 1883, 1879, and 1877

As regards individual diseases, *diarrhœa—the* scourge of Leicester—has with one exception (1879) been responsible for the largest proportion of this mortality in each year, In 1886 (*see* Table III.) the rate per 1,000 deaths from zymotic disease was for diarrhœa as much as 651·4. and in 1890 it was 646·8. That this disorder has not diminished with the progress of sanitation is evident from these figures. Dividing the whole period into three terms of six years, we find the average proportion accruing to this disease, of the years 1875-80, 1881–86, 1887–92, to be 468, 500, and 491 respectively; the mortality for 1893 being considerably above this average.

Table II.

Leicester, 1875 to 1893.

Deaths from Zymotic Disease.

—	Small-Pox.	Measles.	Scarlet Fever.	Diphtheria.	Whooping Cough.	"Fever"			Diarrhœa.	Total.	Proportion of Deaths from Zymotic Disease to 1,000 of Total Deaths from all Causes.
						Typhus.	Enteric.	Continued.			
1875	—	49	175	7	91	64			308	694	240·2
1876	—	50	173	10	33	43			263	572	223·6
1877	6	40	33	9	65	20			185	358	142·3
1878	1	45	12	5	82	31			302	478	191·2
1879	—	72	105	11	61	21			88	358	135·0
1880	—	166	119	23	27	46			398	779	263·1
1881	2	7	184	11	122	29			193	548	206·4
1882	5	74	72	5	19	19			214	408	161·3
1883	3	15	91	6	59	—	10	—	148	332	132·8
1884	—	57	63	11	66	—	16	—	344	557	189·6
1885	—	52	113	14	52	—	36	—	186	453	171·5
1886	—	43	44	4	27	—	19	—	256	393	143·5
1887	—	87	5	13	55	—	31	—	247	438	175·6
1888	—	77	4	13	86	—	32	—	148	360	136·3
1889	—	62	6	10	26	—	22	—	121	247	98·2
1890	—	30	38	11	16	—	24	—	218	337	120·4
1891	—	84	17	14	136	—	29	—	204	484	159·9
1892	6	126	41	10	52	—	17	—	214	466	143·3
1893	15	52	81	20	42	—	47	—	399	656	180·8

Table III.

Leicester, 1875 to 1893.

Proportion of Deaths from Zymotic Diseases.

Per 1,000 Zymotic Deaths.

—	Small-pox.	Measles.	Scarlet Fever.	Diphtheria.	Whooping Cough.	"Fever" Enteric mainly.	Diarrhœa.
1875	—	70·6	252·1	10·	131·1	92·2	443·8
1876	—	87·4	302·4	17·4	57·6	75·1	459·7
1877	16·8	111·7	92·1	25·1	181·5	55·8	516·7
1878	2·1	94·1	25·1	10·4	171·5	64·8	631·8
1879	—	201·1	293·3	30·7	170·3	58·6	245·7
1880	—	213·	152·7	29·5	34·6	59·0	519·9
1881	3·6	12·7	335·7	20·0	222·6	52·9	352·2
1882	12·2	181·3	176·4	12·2	46·5	46·5	524·5
1883	9·	45·1	274·	18·0	177·7	30·1	445·7
1884	—	102·3	113·1	19·7	118·5	28·7	617·4
1885	—	114·7	249·4	30·9	114·7	79·4	410·6
1886	—	109·4	111·9	10·1	68·6	48·3	651·4
1887	—	182·	10·4	27·2	115·0	64·8	516·7
1888	—	214·	11·1	36·1	238·8	88·8	411·1
1889	—	251·	24·3	40·4	105·2	89·0	490·1
1890	—	89·	112·7	32·6	47·4	71·2	646·8
1891	—	173·5	35·1	28·9	280·9	59·9	421·4
1892	12·8	270·0	87·9	21·4	111·6	36·4	459·4
1893	22·8	79·4	123·4	30·4	64·0	71·6	608·2

Next in order of importance as a cause of mortality during these years comes *scarlet fever*, the prevalence of which is naturally more variable. In the five years 1887 to 1889, there was only an average of five deaths annually from this disease; whereas in the three years 1879 to 1881 the annual average was 136. Again, comparing its mortality with that from all the zymotics it is seen that the rate per 1,000 of the latter was for scarlet fever, in each of the three sexennial periods named, 186, 210, and 46 respectively. In 1893 the mortality was 123·4.

In measles the deaths throughout the whole period closely approximate those from scarlet fever, but they are somewhat more evenly distributed. Again, taking the sexennial term, the average annual death-rate (per 1,000) zymotic deaths, for this disease would be 130, 94, and 196 respectively; there being as high a proportion as 270 in 1892. The rate in 1893 was considerably below the average, viz. 79·4.

Lastly, as regards "*fever*," which practically means *enteric fever*, the mortality was highest in 1875, and next highest in 1885. The annual average for the three sexennial periods being 67, 47. and 68 per 1,000 of the total zymotic mortality. In 1893 it was 71·6.

Since 1879 Leicester has enjoyed the advantage of an act for the compulsory notification of infectious diseases, so that for nearly 15 years the statistics of certain of the zymotic diseases are more complete and furnish a better guide to their prevalence than mortality returns can do. In the Tables that follow (Tables IV., V., VI., VII.) figures based on these returns are given, first of the total numbers notified in each year, next of the proportion of cases of zymotic disease per million living, based on the population returns, and then of the relative proportion of cases of small-pox, scarlet fever, enteric fever, and diphtheria.

Table IV.

Leicester, 1879 to 1893.

Cases of Zymotic Disease.

Notifications.

—	Small-pox.	Scarlet Fever.	Enteric Fever.	Diphtheria.	Erysipelas.	Puerperal Fever.	Total.
1879*	—	496	56	24	125	—	701
1880	—	802	245	87	442	6	1,582
1881	5	1,065	179	63	566	15	1,893
1882	20	763	110	38	455	14	1,409
1883	12	797	85	26	317	12	1,249
1884	3	728	55	184	239	—	1,209
1885	8	1,816	216	55	294	8	2,397
1886	1	817	141	51	258	12	1,280
1887	9	272	222	81	308	6	898
1888	21	132	266	67	255	8	749
1889	—	409	147	84	219	1	860
1890	—	516	165	75	207	3	966
1891	—	794	178	65	238	2	1,277
1892	39	1,331	116	67	316	5	1,874
1893	281	2,308	392	139	353	10 Cholera 1	3,484

"The numbers in 1880, 1881, 1882, 1883 are *Certificates* only, and may not include quite all the cases."

* In this year the cases are only reckoned from September 13th to the end of 1879, this being the first day the Act came into effect.

Chart shewing Proportion of Cases of Infectious Diseases notified in the Years 1880 to 1893 inclusive, per 100·000 of Population, and the Proportion of Cases of Scarlet Fever, Enteric Fever, Small Pox and Diphtheria.

1887.

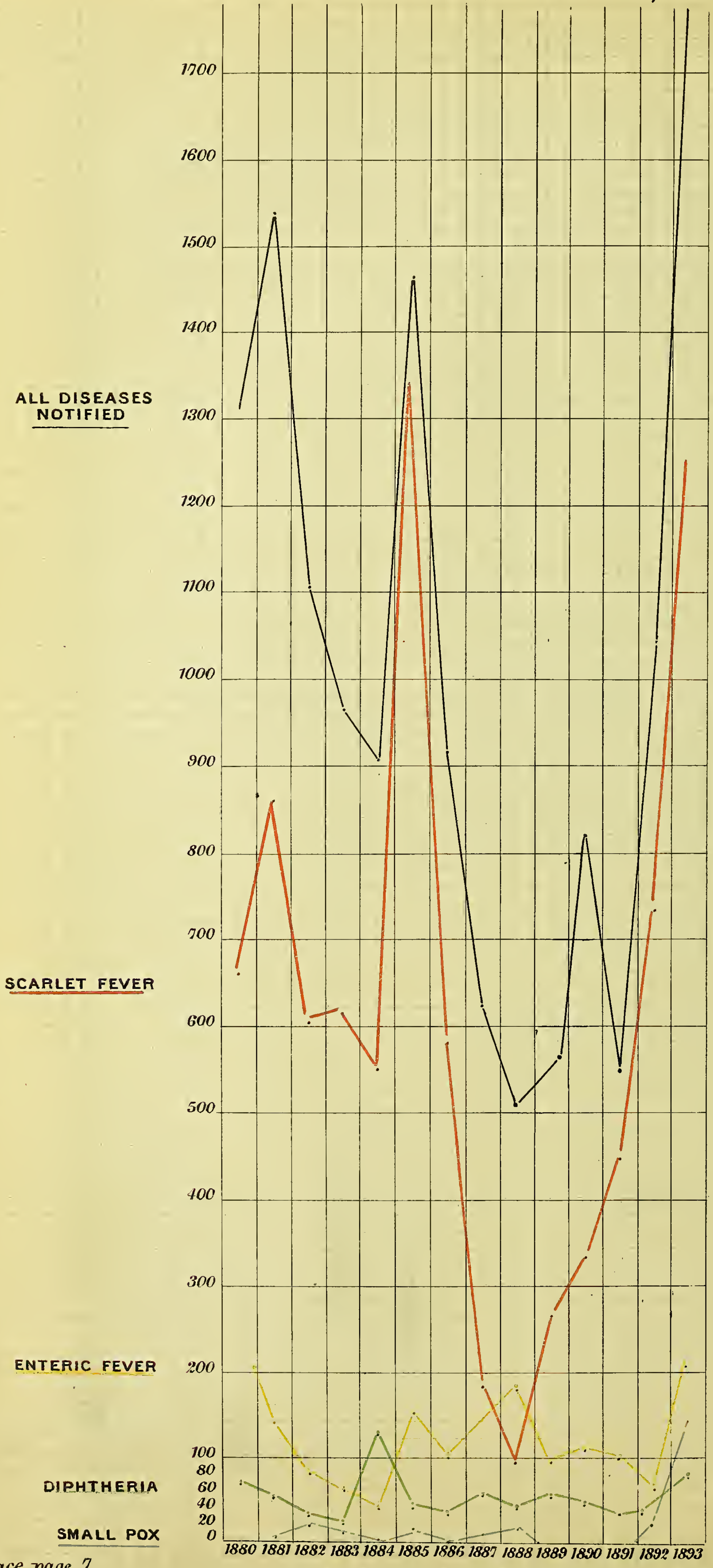

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TABLE V. (and CHART I.)*

LEICESTER, 1880–1893.

PROPORTION per MILLION Population of all Cases of ZYMOTIC DISEASE notified, and of certain such Diseases in particular.

—	Estimated Population.	Proportion of all Zymotics.	Proportion of			
			Small-pox.	Scarlet Fever.	Enteric Fever.	Diphtheria.
1880 - -	120,325	13,147	—	6,582	2,036	723
1881 - -	123,120	15,375	40	8,649	1,453	511
1882 - -	126,275	11,158	229	6,042	870	300
1883 - -	129,483	9,653	92	6,155	656	201
1884 - -	132,773	9,104	22	5,483	414	1,310
1885 - -	136,147	14,667	58	13,338	1,586	403
1886 - -	139,606	9,171	7	5,852	1,009	365
1887 - -	143,153	6,274	62	1,900	1,557	565
1888 - -	146,790	5,102	143	919	1,810	456
1889 - -	150,520	5,713	—	2,717	976	558
1890 - -	154,344	8,228	—	3,336	1,069	485
1891 - -	177,353	5,570	—	4,477	1,003	366
1892 - -	180,066	10,407	216	7,391	644	366
1893 - -	184,547	18,878	1,522	12,506	2,124	753

* *Explanation of Chart I.:—*

Chart showing the proportion of cases of certain of the zymotic diseases notified at Leicester per 100,000 *of the population, in the years* 1880 *to* 1893 *inclusive.*

TABLE VI.

LEICESTER, 1880–1893.

RELATIVE PROPORTION (per 1,000) of Cases of Small-pox, Scarlet Fever, Enteric Fever, and Diphtheria, notified to the Sanitary Authority in Leicester, 1880–1893.

—	Small-pox.	Scarlet Fever.	Enteric Fever.	Diphtheria.
1880 - - -	—	707	216	77
1881 - - -	3	812	137	48
1882 - - -	31	812	117	40
1883 - - -	13	867	92	28
1884 - - -	3	750	57	190
1885 - - -	4	867	103	26
1886 - - -	1	810	139	50
1887 - - -	15	467	380	138
1888 - - -	43	272	547	138
1889 - - -	—	639	230	131
1890 - - -	—	682	218	100
1891 - - -	—	765	172	63
1892 - - -	25	857	75	43
1893 - - -	90	740	125	45

TABLE VII.

LEICESTER, 1880–1893.

CASES of CERTAIN ZYMOTIC DISEASES, DEATHS and MORTALITY.

—	Small-Pox.			Scarlet Fever.			Enteric Fever.			Diphtheria.		
	Cases notified.	Deaths.	Mortality	Cases notified.	Deaths.	Rate.	Cases notified.	Deaths.	Rate.	Cases notified.	Deaths.	Rate.
			Per cent.			Per cent.			Per cent.			Per cent.
1880 - - -	—	—	—	802	119	14·8	245	46	18·5	87	23	26·4
1881 - - -	5	2	40·	1,065	184	17·2	179	29	16·2	63	11	17·4
1882 - - -	29	5	17·2	763	72	9·4	110	19	17·2	38	5	13·1
1883 - - -	12	3	25·	797	91	11·4	85	10	11·7	26	6	23·
1884 - - -	3	—	*nil.*	728	63	8·6	55	16	29·1	184	11	6·
1885 - - -	8	—	*nil.*	1,816	113	6·2	216	36	16·6	55	14	25·4
1886 - - -	1	—	*nil.*	817	44	5·3	141	19	13·4	51	4	7·9
1887 - - -	9	—	*nil.*	272	5	1·8	222	31	14·	81	13	16·
1888 - - -	21	—	*nil.*	132	4	3·0	266	32	12·	67	13	19·4
1889 - - -	—	—	—	409	6	1·4	147	22	15·	84	10	11·9
1890 - - -	—	—	—	516	38	7·3	165	24	14·5	75	11	14·6
1891 - - -	—	—	—	794	17	2·1	178	29	16·3	65	14	21·5
1892 - - -	39	6	15·3	1,331	41	3·0	116	17	14·6	67	10	15·
1893 - - -	281	15	5·3	2,308	81	3·5	392	47	12·	139	20	14·3

Owing to notification also the actual rate of mortality from each of the notified diseases is available, and it will be seen from the above table (Table VII.) how this varies from year to year; the variations being most striking in the case of scarlet fever, and the rate more constant in enteric fever than diphtheria.

§3. *The Fever Hospital.*

The Borough Hospital for Infectious Diseases is situated on rising ground about 1½ miles from the Town Hall, to the north-west. When originally erected in 1870–71 it was well removed from inhabited dwellings, but within the past few years the adjoining district of Newfound Pool has been much built over. This district, formerly outside the borough, is now included within it; and one of its main roads runs from south to north—about 200 yards from the hospital site, separated by pasture land. On the other sides the hospital is fairly isolated—the Corporation owning some of the adjacent property, which is let in allotments—and a branch line of the Midland Railway runs through this land, skirting the grounds of the hospital.

In his report on the Use and Influence of Hospitals for infectious diseases, Dr. Thorne gives a full description of this building which remains much the same as at his visit in 1881. I may, therefore, extract some of the passages from his report, which describe it better than I could do. He writes :—

"Owing to a prevalence of scarlet fever in Leicester in 1870 and 1871, and to the fear that small-pox, then prevalent in several parts of the kingdom, might be imported into the borough, the Town Council determined in the latter year on the erection of some galvanised iron buildings to serve as a hospital for infectious diseases other than enteric fever, for which disease there is special provision in the fever house in connexion with the Leicester Infirmary. The site chosen consisted of about two acres of Corporation property known as Freake's Ground, which is situated just outside and to the north-west of the borough. During the erection of the buildings, however, small-pox became widely epidemic in Leicester; and it was found necessary to use certain premises in Friars Road as a temporary hospital. Later on, also, additional buildings were erected on Freake's Ground and hospital tents were brought into use.

"The hospital on Freake's Ground is known as the Borough Fever Hospital. The soil on which it stands is clay. Close by are some brick works and also the town deposit for ashes and dry refuse.

"The buildings are enclosed by a wooden fence and consist of (1) one principal group of buildings arranged along the sides of a common corridor (2); a detached ward-pavilion, and (3) certain out-buildings, including the porter's lodge, a laundry, a disinfecting chamber, an ambulance shed containing an ambulance fitted with a movable stretcher, and a mortuary.

"The principal buildings are constructed of galvanised corrugated iron painted outside, and they are lined throughout with wood. They rest on brick piers and have slate roofs. The corridor, which runs the whole length of the building, is well ventilated by means of double-hung sash windows in its opposite sides. On each side of the corridor are three detached buildings. Then on one side are the administration block, and two blocks containing accommodation for nurses and stores; on the other side are three separate ward pavilions known as 'fever wards.' The administration block contains the principal entrance lobby, rooms for the matron, nurses, and servants, a kitchen and scullery, a surgery and store room.

* * * * * *

"Opening out from one end of the corridor above referred to are some additional wooden buildings, which were erected on account of the small-pox epidemic of 1871. One building is now used for stores, another for additional sleeping accommodation for nurses, and a third is a ward pavilion retained for small-pox cases. This pavilion consists of three wards *en suite* and is partly roofed with slate and partly with felt. It has one window at the extreme end, but throughout its entire length the only windows consist of sheets of glass let into the walls about eight feet above the floor level, and ten others fitted in frames so as to open. The roof is lowered and there are apertures for ventilation in the centre of the floor. About the middle of the building is a small ward kitchen, and at the side are waterclosets somewhat imperfectly separated from the wards.

* * * * * *

"There is accommodation for 28 small-pox patients in this pavilion and when it is in use a communication with the remainder of the buildings is cut off by means of a doorway at the end of the corridor referred to. By means, however, of a sliding panel in the door, food and other necessaries are passed from one part of the building to the other. I am informed that hitherto there has been no spread of infection, either from this pavilion to the fever wards or by means of the common corridor, from one of these latter wards to another.

"The detached pavilion is professedly reserved for cases of erysipelas. In point of construction it is very similar to the small-pox pavilion, but it is somewhat dilapidated, and, apart from two rooms at one end and which were constructed as nurse's rooms, it is not fit for the reception of the sick. Both this and the small-pox pavilion were originally coated with tar. Since then they have been whitewashed, but they remain very unattractive in appearance."

In the first (1885) of the series of admirable annual reports which were compiled by the late Medical Officer of Health, Dr. H. Tomkins, the following remarks on hospital accommodation appear:—

"Leicester has for some years been provided with a hospital, such as it is, for this purpose (*i.e.*, isolation of infectious diseases), but unfortunately it belongs to that class of structures which until the last few years has too often obtained in other towns. Intended at first as a more or less temporary building, constructed hurriedly, and on an ill-designed plan, it may not inappropriately be termed an ugly makeshift. Having, however, been partly covered externally with corrugated iron, it has withstood the wear and tear of 12 or 13 years' use better than many others constructed entirely of wood. Erected originally to meet an outbreak of small-pox, it consists of five blocks, three containing one large ward each, and the other two only partially divided, and provides but unsatisfactory accommodation for the treatment of small numbers of patients, or for the convenient separation of such cases as may be desirable to isolate from others. It is also in many respects deficient in the accommodation and arrangements adopted in modern hospitals of this description."

Nevertheless in spite of these inadequacies the building has been maintained in full working order—throughout the 20 years of its existence. The main portion—with three wards coming off the corridor on the right hand, and administration offices on the left—has been always set apart for the reception of cases of scarlet fever, when its original occupation by small-pox patients in 1872 was over; and from that time until the autumn of 1892 no small-pox case was admitted into those wards. These three wards are well kept, and lighted and commodious; and are equal to those of many similar institutions in the country. But the same cannot be said of the two large detached pavilions, which form the wings of the hospital. These buildings are constructed of wood, the roofs covered by felt, and they naturally show far more evidence of the exposure and wear of twenty years than the rest of the hospital. The ground on which they stand slopes downwards to the east and consequently they are constructed in portions at different levels coming close to the railway above mentioned. Although lofty and capacious, they are bare and comfortless; and are lighted by continuous windows at the eaves. Nor have they been in constant use. The northern wing has been set apart for the reception of cases of small-pox which have occurred from time to time, up to the present outbreak; and at other times, measles and other infectious diseases have been accommodated. The southern block, which is more widely separated from the main building—the laundry, disinfecting station, &c. intervening—is termed the "erysipelas" ward, but has been devoted to other purposes also, *e.g.*, the reception of fever convalescents, and of persons quarantined for small-pox, or for doubtful cases. The accompanying illustration (*see* Plates I. and II.) from photographs taken at my request in January 1892, shows the nature of this building, and the state into which it has fallen. The interior is bare and is divided into three large wards,* all inter-communicating, one of which was set apart as a living room, and the others fitted up with beds when used for quarantine purposes. The sanitary accommodation is bad, and I am informed that the building is infested by rats. I cannot avoid expressing the opinion that these two wooden buildings are a reproach to the authorities, and that being clearly erected for a temporary purpose should long since have been replaced by more substantial structures.

In the autumn of 1892 an annex was built at the northern extremity of the corridor for the accommodation of the nursing staff, thus setting free some rooms which could be used as small wards.

Lastly, with the decline of the small-pox in 1893, it was resolved to re-open the wards to scarlet fever, and to erect a detached building in the north-eastern part of the site as a small-pox pavilion, a work which had just been completed when my visits ceased.

The use to which this hospital is put may be seen from the following return (Table VIII.) of the annual admissions since 1879 in comparison with the numbers notified in the borough. The vast majority have been cases of scarlet fever, of which disease 12,250 cases have occurred during the 14 years (1880 to 1893), and 5,560, or less than one half have been admitted. On the other hand, almost every case of small-pox notified has been isolated and a few cases admitted from outside the borough. It is noteworthy that, in 1893, when the hospital was closed to fever, more cases of that disease occurred in the borough than in any previous year in which notification has been in force.

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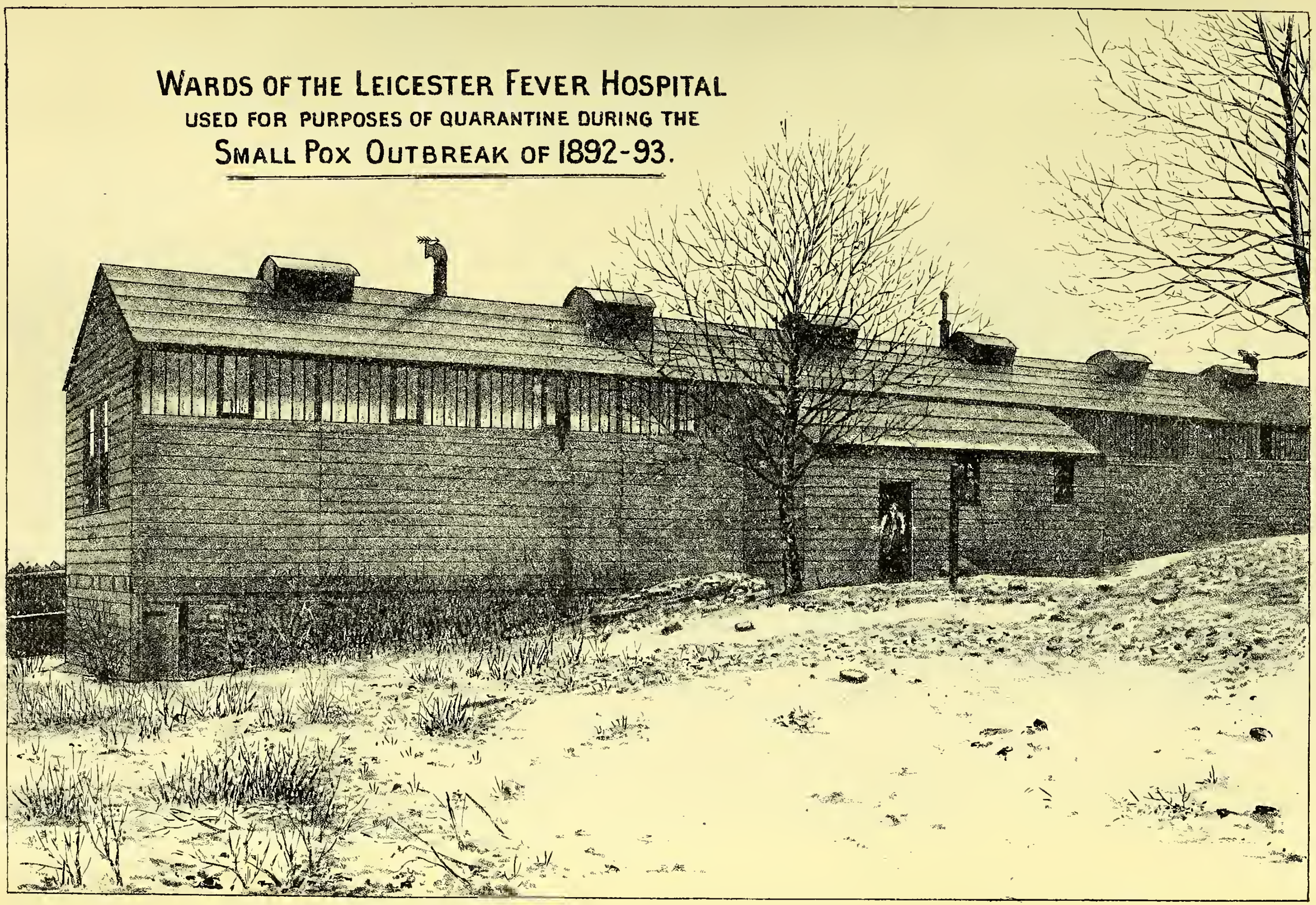
* During the small-pox outbreak—when this building was being used for quarantine—the lower wards were improved by being divided by wooden partitions into smaller rooms capable of accommodating varying numbers of beds, and permitting of the separation of the sexes. At my last visit I found these partitions had been removed, it being intended henceforth to utilise the building for scarlet fever convalescents.

Plate I.



WARDS OF THE LEICESTER FEVER HOSPITAL
USED FOR PURPOSES OF QUARANTINE DURING THE
SMALL POX OUTBREAK OF 1892-93.

Wyman & Sons, Ltd, Lith, 6516·12·94

To face page 8 (i).

WARDS OF THE LEICESTER FEVER HOSPITAL
USED FOR PURPOSES OF QUARANTINE DURING THE
SMALL POX OUTBREAK OF 1892-93.

Wyman & Sons, Ltd, Lith, *6516·12·94*

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TABLE VIII.

LEICESTER FEVER HOSPITAL.

TABLE showing Number of Patients admitted since 1879, and the Number of Cases of Infectious Disease notified in the Borough.

—	Small-pox.		Scarlet Fever.		Enteric Fever.		Erysipelas.		Admission of other Diseases.		Quarantine.	—
	Notified.	Admitted.	Notified.	Admitted.	Notified.	Notified.	Notified.	Admitted.	Measles.	Unclassified.		
1880	—	1	802	230	245	5	442	47	—	—	Prior to 1885 no record of numbers quarantined.	
1881	5	6	1,065	388	179	—	566	46	—	—		
1882	29	30	763	460	110	—	455	44	—	—		
1883	12	12	797	383	85	—	317	12	—	—		
1884	3	6	728	384	55	—	239	5	—	—		
1885	8	8	1,816	900	216	—	294	3	—	3	10	
1886	1	1	817	439	141	—	258	—	10	5	2	
1887	9	10	272	151	222	13	308	1	—	2	14[a]	[a] 2 developed small-pox.
1888	21	23	132	94	266	—	255	1	—	—	39[b]	[b] 3 developed small-pox.
1889	—	—	409	327	147	1	219	1	1	—	—	
1890	—	—	516	471	165	3	207	1	1	4[c]	—	[c] Varicella, 1.
1891	—	—	794	636	178	—	238	—	2	12[d]	—	[d] Varicella, 6
1892	39	38	1,331	727	116	—	316	—	6	4[e]	97[f]	[e] Varicella, 4. [f] 2 developed small-pox.
1893	281	281	2,308	—	392	—	353	—	—	10	144[g]	[g] 14 developed small-pox.

§4. SMALL-POX in LEICESTER—1852 to 1891.

From the reports of the medical officers of health, information respecting the mortality from small-pox is available for a period of 40 years. This I have reproduced below, and have appended an estimate of the total number of cases on the basis of a mortality of 10 per cent.

TABLE IX.

DEATHS from SMALL-POX at LEICESTER, 1852 to 1891.

Year.	Estimated Population.	Small-pox Deaths.	Small-Pox, Estimated. (No. of Cases.)
1852	61,403	52	520
1853	62,164	11	110
1854	62,925	0	0
1855	63,686	0	0
1856	64,447	1	10
1857	65,208	17	170
1858	65,969	53	530
1859	66,730	3	30
1860	68,056	2	20
1861	68,257	1	10
1862	68,797	0	0
1863	72,130	5	50
1864	78,337	104	1,040
1865	80,500	10	100
1866	83,750	3	30
1867	86,000	2	20
1868	90,000	1	10
1869	91,500	0	0
1870	95,083	0	0
1871	97,500	12	120
1872	100,829	346	3,460
1873	102,515	2	20
1874	106,202	0	0
1875	111,000	0	0
1876	113,581	0	0
1877	117,461	6	60*
1878	121,473	1	10
1879	125,622	0	0
1880	120,325	0	0†
1881	123,120	2	5‡
1882	126,275	5	29
1883	129,485	3	12
1884	132,773	0	0
1885	136,147	0	8
1886	139,606	0	1
1887	143,153	0	7
1888	146,790	0	21
1889	150,520	0	0
1890	154,344	0	0
1891	177,353	0	0

* System of quarantine initiated. † Notification enforced.
‡ Actual number known.

In his report for 1883 Dr. W. Johnston, then Medical Officer of Health, points out that during the preceding seven years there had been no fewer than 17 importations of the disease, and he regards the continued exemption of the borough from any epidemic as being highly satisfactory, and "altogether due to the success which has hitherto "attended the efforts of the Health Committee in securing "not only the immediate reporting, but also the prompt "removal to hospital of all the cases as they came under "notice."

To this must be added the carrying out of a system of quarantining of those in contact with small-pox cases, which has formed a notable feature of the measures adopted in Leicester against the spread of small-pox. I propose, therefore to give a short account of the history of this system up to the present outbreak. In addition to published records, I have had the opportunity of conversing on the subject with the chairman of the Health Committee, Dr. Johnston, and Mr. Braley, to whom I tender my thanks for the information they freely gave me.

§5. SMALL-POX QUARANTINE IN LEICESTER.

The first mention of the adoption of a system of quarantine for all persons who had been presumably in contact with a case of small-pox occurs in Dr. Johnston's Report for 1877; and it is to this gentleman that is due the credit of having introduced this safeguard as a routine measure.* In 1877, 12 cases of small-pox were registered (this was prior to the introduction of notification). Dr. Johnston writes:—

"As the plan which I adopted in the removal of these cases is novel, and may be found useful by officers of health in other towns for preventing the spread of the disease, I may be pardoned, if I again draw attention to it. In every house where a small-pox case occurred I endeavoured to impress the inmates with the fact that the removal of *all* the members of the family to the hospital was the best course to adopt, not only as regarded their own individual welfare, but also that of the town at large, and I am glad to say that all complied with my request, left their infected habitations, and became inmates of the hospital. Altogether 22 unaffected cases were thus admitted into quarantine, and of these 3 after admission sickened. The first case sickened in 48 hours, the second in 72 hours whilst the third showed no symptoms of the disease until the 12th day. . . . The suppression of what might otherwise have proved a widespread epidemic, attended with great fatality, was entirely due to the early information recorded of the cases affected, and the promptitude observed in their removal."

It was the custom, Dr. Johnston informed me, for the Corporation to pay the wages of the quarantined during their fortnight's detention; and they were allowed comparative freedom within the hospital grounds.

Nor was the removal to quarantine in all cases restricted to the members of an infected household; if it appeared that others had been in prolonged contact with the patient they also were persuaded to take this step.

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* In his report for 1875 (p. 5), the late Dr. Crane, then medical officer, states that he removed to the hospital a child suffering from small-pox *together* with its parents. The child died, but the parents who had thus been practically "in quarantine" did not take the disease.

Hitherto there had been few objections on the part of individuals to go into quarantine; but in the few instances in which this had occurred, they were visited daily by the sanitary inspector and any signs of failing health reported to the Medical Officer. On one occasion Dr. Johnston succeeded in removing all the inmates of a lodging-house, 39 in number, two cases of small-pox having occurred in tramps who were dwelling there.[*] Again, in case of refusals, not only were the infected dwellings watched, but the employers of those who were engaged at work were informed of the fact that there was small-pox in the house. No more pressure was put on the folk than this, and it generally sufficed. Indeed, Mr. Braley informed me that he had never known a man lose his employment because of his detention in quarantine.

Although apparently, since the introduction of this system up to the present outbreak, there has been no instance of a quarantined inmate contracting small-pox at the hospital from proximity to the small-pox wards, it should be borne in mind that until 1892 the small-pox cases were confined to the special wing and not introduced into the main building. Mr. Braley recalled an instance in which the period of quarantine was too short, viz., only 12 days, and after the family returned home another member sickened, and the rest had all to undergo another fortnight's quarantine.

The part of the hospital buildings utilised for the purposes of quarantine has not invariably been the same. (*See* annexed Plan III.) In the first instance the large wooden building close to the entrance (south side) and farthest from the wards was utilised. It had since its erection been mainly devoted to cases of erysipelas, which used then to be admitted to the hospital, and was often spoken of as the "erysipelas ward," for it was then a single shed. It was subdivided into three large wards during Dr. Tomkins tenure of office, and apportioned by him to the reception of convalescent fever patients,[†] to which purpose it remained devoted until the present small-pox outbreak, when it has again been utilised for quarantine. In the meantime, two small wards at the north end of the building (marked 9, 10, in plan) opening into the corridor on the one hand and externally on the other, were set apart for quarantine; and have thus come to be known as the "quarantine wards." They are situated within a few yards of the north building (detached) used for the reception of cases of small-pox.

To show how seriously deficient is the accommodation in this hospital, it may be said that when not in use for quarantine these two rooms were occasionally utilised as a nurses' dormitory,[‡] and that even when small-pox cases were in hospital, the nurses occupied two small rooms of the block apportioned to small-pox. The erection of an additional building for the nursing staff beyond this block was fortunately completed before small-pox became prevalent in 1892.

It has not been possible to get complete statistics of the numbers sent into quarantine since the system was initiated, but the returns for recent years have been kept.

—	Cases of Small-pox admitted from Borough.	Numbers of Persons in Quarantine.
1877 - - -	12	22
1878 - - -	8	96 ?§
1879 - - -	—	
1880 - - -	1	
1881 - - -	6	
1882 - - -	25	
1883 - - -	9	
1884 - - -	3	
1885 - - -	8	10
1886 - - -	1	2
1887 - - -	9	14 ‖
1888 - - -	21	39¶
1890 - - -	—	
1891 - - -	—	
	103	183

If these figures are correct it is obvious that they cannot include all those who were exposed to the possibility of infection from the 103 cases of small-pox primarily admitted into hospital during these years.

The advantages of a quarantine system, if it could be practically enforced, are:—

(1.) The prevention of spread of disease by persons coming from infected houses.

(2.) The detection at the earliest possible moment of members of the family developing small-pox subsequent to the first case.

(3.) The facilities it affords for thorough disinfection and cleansing of the house vacated by the family.

But to be practically effectual this system not only requires the cordial co-operation of all concerned, but needs that the accommodation supplied by the authorities should be adequate and acceptable. So long as only a few cases of small-pox are present in a borough, it may be possible to meet these wants without entailing too much expense. But if the disease attain epidemic proportions the mere housing of all the families infected must entail the provision of adequate accommodation on a scale that few towns could furnish. Then, too, where as at Leicester the quarantine accommodation is of the barest; and the commingling of the quarantined in sleeping and dwelling rooms unavoidable, residence in quarantine for a fortnight might well be dreaded by self-respecting people.

On the other hand, if the system is to be carried out with efficiency and to be regarded by the people at large as a salutary provision, and one to which they ought to submit for the sake of the community, the town should see to it that the buildings provided for the purpose are of such a character as to supply comfort and privacy to every family.

In this regard Leeds[*] has advanced far beyond Leicester, for it has erected a considerable number of cottage dwellings for temporary occupation by the quarantined. Having had the opportunity of contrasting the provisions in the two towns, it has, I confess, been a matter of surprise to me that the Leicester people should have rested satisfied with the accommodation provided for them.

It is not surprising, then, that in 1893 it was found necessary to abandon the system of interning families in the hospital quarters, and to substitute for it the practice (which had always been adopted when persons refused to go to hospital quarantine) of daily inspection of infected houses, a practice which is customarily carried out in other towns during epidemics of small-pox. I am not prepared to say that with due vigilance this ordinary and obvious method may not be almost as efficacious for the purpose as that of hospital quarantine. It lacks, however, the advantage of the individuals living under constant medical supervision.

§6. *Procedure in dealing with Small-pox.*

In the case of a disease so highly contagious as is small-pox a great deal of the efficacy of the measures taken to deal with it must depend upon the promptitude and vigour with which they are carried out. I can fully testify that these qualities animate the Leicester sanitary authority in their treatment of small-pox. Upon the receipt of the notification, the ambulance is sent to convey the patient to hospital; and the chief sanitary inspector institutes inquiries as to the possible source of infection of the case. During the present outbreak I have been struck by the diligence with which the medical officer and chief sanitary inspector have thus prosecuted inquiries, with the result that I think fewer cases have been left "untraced" than often happens. The history of the patient during the previous fortnight is minutely inquired into; and in particular information is gathered as to those who may have been in contact with him or have visited the house since it became infected. This, it seems to me, is often a matter of difficulty; for it is hardly safe to assume that the dwelling has only been infected since the patient sickened. He may be (and indeed not infrequently is) the medium of infection of other members of the family through fomites in his clothing 12 or 14 days before he has any symptoms himself; and similarly he may convey the contagium to fellow-workers in a factory, to a school, or to persons with whom he has social or business relations. The risk of this is not so great obviously as is that of infection from himself direct; but here, too, it must be borne in mind that the pre-eruptive stage of the disease is an infectious period, and the removal of a case as soon as its nature is determined, *i.e.*, when the rash is well out (about fourth or fifth day) will not prevent, although it may greatly diminish, the chances of further cases occurring in the household. It will be seen subsequently that a large proportion of the cases were removed early in the disease.

On removal of the case, and of the household (if sent to quarantine) the house is fumigated with sulphur; "liquid "disinfectants are used freely in the drains and about the "yard; and the ashpit is emptied and disinfected; the

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[*] I was informed by Mr. Biggs (December 20, 1892), that originally the quarantine hospital block was only intended for tramps, &c.; and that families were taken in subsequently.

[†] As many as 100 children convalescent from scarlet fever have been lodged here at one time.

[‡] These rooms have not, however, been used for this purpose during the tenure of office of the present matron, *i.e.*, the past nine years.

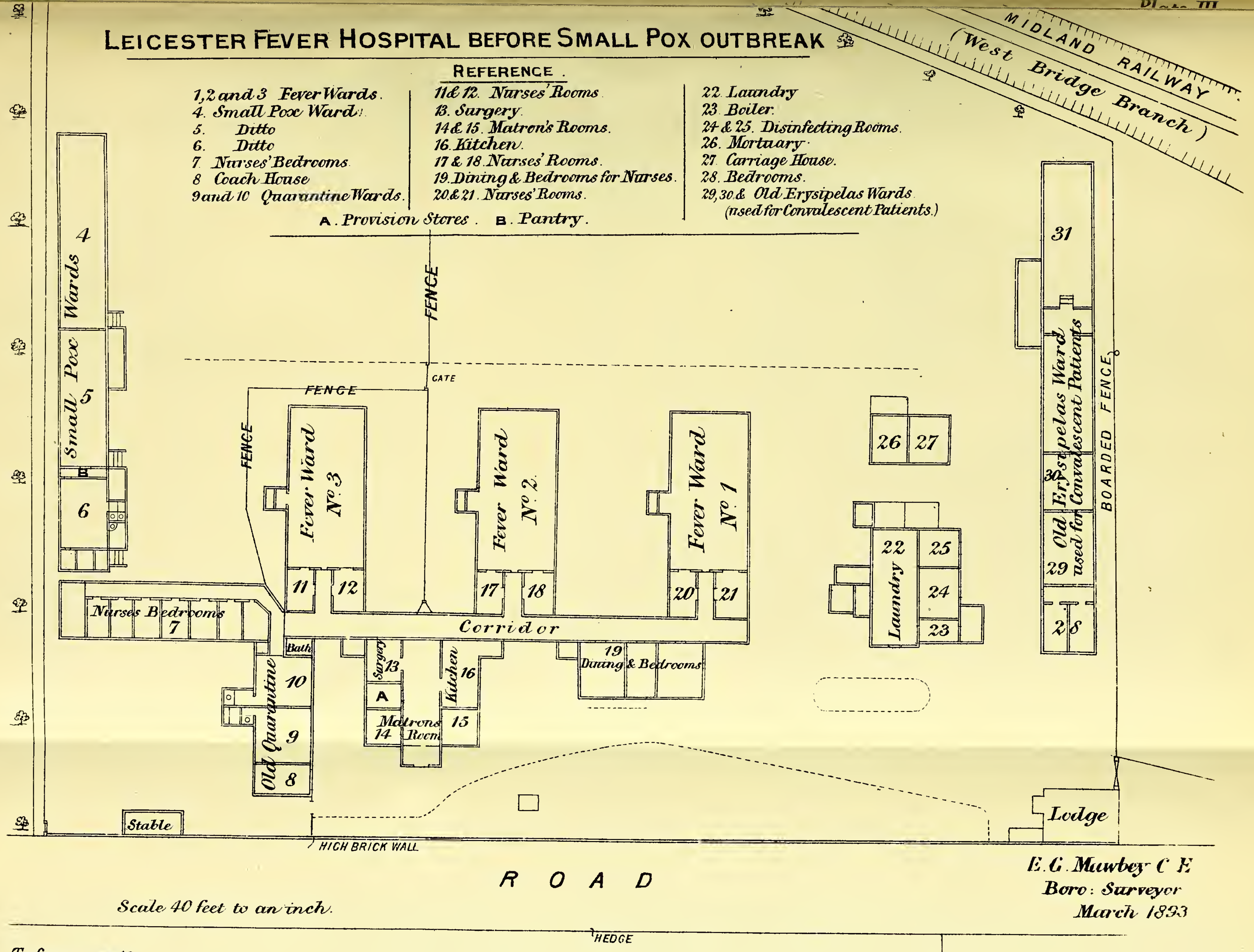
[§] I was informed by Mr. Biggs that from 1877 to 1885 inclusive there had been 128 persons quarantined, but there is no official record of the numbers in these years.

[‖] Two developed small-pox and appear in that column also.

[¶] Three developed small-pox and appear in that column also.

[*] At Glasgow, too, there is considerable provision for similar quarantine.

LEICESTER FEVER HOSPITAL BEFORE SMALL POX OUTBREAK



REFERENCE.

1, 2 and 3 Fever Wards.
4. Small Pox Ward.
5. Ditto
6. Ditto
7. Nurses' Bedrooms
8. Coach House
9 and 10 Quarantine Wards.
11 & 12. Nurses' Rooms.
13. Surgery.
14 & 15. Matron's Rooms.
16. Kitchen.
17 & 18. Nurses' Rooms.
19. Dining & Bedrooms for Nurses.
20 & 21. Nurses' Rooms.
22. Laundry
23. Boiler.
24 & 25. Disinfecting Rooms.
26. Mortuary.
27. Carriage House.
28. Bedrooms.
29, 30 & Old Erysipelas Wards
(used for Convalescent Patients.)

A. Provision Stores. B. Pantry.

Scale 40 feet to an inch.

E. G. Mawbey C E
Boro: Surveyor
March 1893

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"next day the bedding is taken to the disinfecting chamber "and subjected to the hot air process."[*]

The disinfecting chamber was one of Ransome's, exchanged in 1888 for a more efficient steam disinfector by Goddard and Massey. It is erected on the hospital grounds.

Before leaving the hospital the patients have a final disinfecting bath, and their clothes are strongly disinfected.

§7. THE DECLINE OF VACCINATION IN LEICESTER.

I have not deemed it necessary to enter into any details concerning the history of vaccination in Leicester, as upon this subject abundant information has already been furnished to the Commission.

In view of the present outbreak it may, however, be of interest to quote the statements of Dr. Tomkins, late medical officer of health, in his annual report for the year 1887. He there writes (p. 72) :—

"For the past two years all compulsion or any attempt to carry out the vaccination laws has been abandoned, and thus not only those persons who have a disbelief in the protection afforded by this operation against an attack from small-pox, or have any other conscientious objection to it, are amongst the defaulters, but also large numbers of that numerous class who, from sheer carelessness and thoughtless ignorance, neglect to protect their children from this loathsome disease.

"It is only from about the year 1883 that any considerable number of children have been allowed to grow up in the town without being vaccinated. An instructive return was published last year by the Leicester Guardians, which showed that out of 33,659 children born from 1880 to 1886, both years inclusive, only 14,024 were known to have been vaccinated. It shows also that 4,765 had died unvaccinated, leaving a total of 14,870 who had not been submitted to that operation. Seeing, however, that the mortality of children under five years of age is in Leicester very high, it will not be over-estimating it to set down another 2,000 deaths as having occurred amongst these 14,870 unvaccinated children. It is to be noted also that 6,430 have accumulated during the last two years to which the report refers, *i.e.*, in 1885 and 1886. Speaking roughly from these dates, it may be assumed that there are from twelve to fourteen thousand unvaccinated children to-day within the borough, or some 10 to 12 per cent. of the entire population.[*] These particulars will be of interest, not only to the inhabitants of Leicester, but to the country at large, which is watching with some interest as to what may be the ultimate result of this wholesale neglect of vaccination. They will also serve to correct the exaggerated notions that prevail in some quarters, that by far the greater proportion of the inhabitants of Leicester are unvaccinated, whereas exactly the opposite condition is the fact. Should, however, the present state of things continue to go on, and 10 per cent. only of the children born are vaccinated, as happened last year, then in the course of eight or ten years from the present time, there will have accumulated a sufficient amount of 'inflammable material' to warrant the use of the term 'Leicester experiment' being applied to the town. Whether the present vigilant measures of isolation and quarantine will suffice to successfully deal with any outbreak of small-pox which may then arise, time only can prove. One thing is, however, certain, that any of these unprotected children have but to be brought in contact with a breath of infection from small-pox to almost invariably contract the disease."

TABLE X.

RETURN of VACCINATIONS in the LEICESTER UNION.

Year.	Births Registered during Year.	Of the Children whose Births were Registered during the Year given in the First Column, by the 31st January in the Year next but one following that Year there were :—						
		Successfully Vaccinated.	Certified as Insusceptible of Vaccination.	Had Small-pox.	Died Unvaccinated.	Vaccination postponed by Medical Certificate.	Remaining.	The Children not finally accounted for (including Cases postponed) being per cent. of Births.
1872	4,154	3,422	6	16	574	136		3·3
1873	4,446	3,730	6	0	555	5	150	3·5
1874	4,365	3,590	9	0	643	19	104	2·8
1875	4,256	3,400	10	0	662	12	172	4·3
1876	4,773	3,650	9	1	679	27	407	9·1
1877	4,749	3,509	7	0	647	37	549	12·3
1878	4,777	3,260	4	0	707	108	698	16·9
1879	4,695	3,086	2	0	722	25	860	18·8
1880	4,860	3,010	5	0	816	14	1,015	21·2
1881	4,712	2,948	3	0	687	47	1,027	22·8
1882	4,855	2,660	7	0	720	36	1,432	30·2
1883	4,819	1,967	8	0	735	6	2,103	43·8
1884	4,849	1,700	9	1	818	24	2,297	47·9
1885	4,690	1,481	6	0	760	14	2,429	52·1
1886	4,864	655	2	0	847	3	3,357	69·1
1887	4,693	343	3	0	961	0	3,386	72·2
1888	4,805	220	0	0	885	0	3,700	77·0
1889	4,786	127	4	0	834	0	3,821	79·8
1890	4,697	118	0	0	882	1	3,696	78·7
1891	4,785	74	1	0	885	0	3,825	79·9
1892	5,816	132	0	0	1,024	0	4,660	80·1

It may be remarked that according to the returns furnished by the Medical Officers of Health the numbers vaccinated at the public stations have fallen of late years more rapidly than the private vaccination, the former being in 1887, 188; 1880, 80; 1889, 31; 1890, 12; 1891, 6.

§8. SMALL-POX AT LEICESTER.

1892–93.

Early in the year 1892 a doubtful case of small-pox occurred in the town, but no other cases arose from it. The patient was, however, promptly isolated, and six inmates of the same house were removed to the hospital and detained in quarantine for a fortnight.

At the end of August a case was introduced into the town in the person of a tramp admitted into the Workhouse Infirmary. From that time for a period of 70 weeks—with one or two exceptions—cases continued to occur, *i.e.*, from the week ending August 24th, 1892, to the week ending December 27th, 1893.

The following account will be strictly confined to this period, and the cases considered include not only those that were duly notified, but also those cases that passed unrecognised at the time (most of whom never sought medical advice) but subsequently came to the knowledge of the authorities.

The total number of cases thus collected amounts to 357, of whom 181 were males and 176 females.

There were 21 deaths, a mortality of 5·8 per cent.; but of the males there were only 7 deaths or 3·5 per cent.; of the females, 14 deaths, or nearly 8 per cent.

In the following table a detailed list is given of these cases, which are recorded in the order of their onset, and appended is a record of the number of inmates of the houses whence they came arranged in four age-periods :—

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[*] Statement by chief sanitary inspector quoted by Mr. Biggs in an article, "How Leicester deals with Small-pox." Reprint from "The Vaccination Inquirer," November 1, 1892.

[*] It will be seen subsequently that out of 1,231 inmates of 193 households invaded by small-pox in 1892–3, there were 331 children living below the age of ten years, and that 283 of these children were unvaccinated, a proportion of 23 per cent. of this limited population.—S. C.

Table of Cases of Small-pox.

Leicester, 1892–3.

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
1	W. S.	M.	35	1892. Sept. 9	1892. —	1892. Aug. 24	1892. Aug. 24 W	1892. Aug. 30	Mild	Rec.	8 ?	Infancy: small smooth marks.	A tramp admitted to workhouse Aug. 24.	Not recognised	—	—	—	—	—
2	S. M.	F.	23	„ 9	Sept. 4	Sept. 8	Sept. 9	Oct. 22	Discrete	„	49	Infancy: 2 marks	Living at lodging-house where No. 1 went on Aug. 20.	-	2	—	—	2	—
3	J. B.	F.	28	„ 10	„ 5	„ 7	„ 10	Nov. 3	Confluent	„	60	*Unvaccinated*	Do. do. do.	Dusky rash; high fever.	3	1	—	1	1
4	W. H.	M.	57	„ 12	—	„ 9	„ 10	Sept. 16	„	Died	8	Uncertain. (Had been in navy.)	Debilitated by tertiary syphilis. Occupied bed in ward at workhouse next to No. 1.	-	—	—	—	—	—
5	E. B.	F.	9 months.	—	Sept. 27	„ 27	—	—	Mild	Rec.	?	"Under" vaccination	-	A doubtful case	3	—	—	—	—
6	E. J. K.	M.	35	Oct. 3	„ 28	Oct. 3	Oct. 3	Dec. 3	Confluent	„	67	Infancy: 4 marks	-	Onset and eruption severe, but arrest at maturation.	4	—	3	1	2
7	E. K.	F.	4	„ 19	Oct. 14	„ 15	„ 19	„ 10	Mild	„	58	"Under" vaccination, Oct. 4; 2 marks.	Sent to quarantine Oct. 3. Developed scarlet fever Oct. 11.	Rash at first mistaken for varicella.	4	—	—	—	—
8	P. J.	F.	21	„ 21	„ 12	„ 17	„ 21	„ 5	Confluent	„	38	Infancy: 4 foveate marks.	No. 5, taken charge of by Mrs. G. on its leaving quarantine, Sept. 19.	-	5	—	—	1	2
9	E. R.	F.	24	„ 21	„ 17	„ 19	„ 20	„ 17	Confluent (with hæmorrhage).	„	62	*Unvaccinated*	Neighbour to No. 8, often nursed No. 5.	High fever; delirium	6	—	—	4	1
10	G. M.	M.	57	„ 25	„ 18	„ 21	„ 25	„ 24	Coherent	„	68	Infancy; 3 marks	Did not lie up at first	Iritis	7	—	—	—	—
11	G. B.	M.	4	„ 31	„ 26	„ 27	„ 28	„ 19	„	„	55	*Unvaccinated*	Admitted for scarlet fever Oct. 7. Varicella Oct. 11; sent to special ward where No. 6 admitted on Oct. 15.	-	—	—	—	—	—
12	E. L.	F.	3	Nov. 3	„ 26	„ 29	„ 31	Nov. 21	Malignant	Died	27	„	Admitted for scarlet fever Oct. 18	Adenitis	—	—	—	—	—
13	T. G.	M.	43	Oct. 29	„ 27	„ 29	„ 29	Dec. 24	Confluent	Rec.	59	Infancy: 3 marks	Employed in hospital attending to fires, &c.	-	8	—	—	—	—
14	J. F.	M.	3	Nov. 3	29	„ 31	„ 31	„ 18	„	Died	51	*Unvaccinated*	Admitted for scarlet fever Sept. 15. Varicella Oct. 10. Sent to special ward Oct. 12, where No. 6 admitted on 15th.	-	—	—	—	—	—
15	F. B.	M.	7	„ 3	„ 29	Nov. 1	Nov. 1	1893. Feb. 9	„	Rec.	104	„	Admitted for scarlet fever Oct. 19	Adenitis	—	—	—	—	—
16	S. W.	F.	5	„ 3	„ 30	„	Oct. 31	1892. Dec. 10	Discrete	„	42	„	Admitted for scarlet fever Sept. 15. Varicella Oct. 6. No. 6 placed in same bed Oct. 15.	-	—	—	—	—	—
17	M. A. J.	F.	45	„ 5	Nov. 2	„ 4	Nov. 4	Nov. 14	Confluent	Died	13	Infancy: 2 marks	Hospital laundress; intemperate; refused re-vaccination.	-	9	—	—	1	2
18	M. S.	F.	35	„ 5	„ 3	„ 5	„ 5	Dec. 31	„	Rec.	59	„ 2 „	Aunt to No. 9, where she visited before removal.	-	10	1	—	2	1
19	T. R.	M.	45	„ 6	„	„ 5	„ 5	1893. Jan. 14	„	„	73	„ 3 „	Same lodging-house as No. 10	Pleurisy; bronchitis	7	—	—	—	—
20	N. H.	F.	7	„ 10	„ 3	„ 5	„ 9	1892. Dec. 17	Discrete	„	45	*Unvaccinated*	Scarlet fever followed by varicella. Left hospital 15th.	-	11	—	1	2	2
21	H. C.	F.	7	„ 16	„ 1	„ 12	„ 14	Nov. 21	Confluent	Died	12	„	Admitted with scarlet fever Oct. 9	Hæmorrhagic rash; delirium.	—	—	—	—	—
22	W. W.	M.	49	„ 15	„ 12	„ 14	„ 14	1893. Jan. 9	Coherent	Rec.	59	„	-	-	—	—	—	—	—
23	R. L.	M.	6	„ 18	„ 18	„ 16	„ 19	1892. Dec. 31	„	„	49	„	-	Conjunctivitis	12	—	3	2	2

Table of Cases of Small-pox—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates. Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
24	J. H. J.	M.	21	1892. Nov. 19	1892. Nov. 14	1892. Nov. 16	1892. Nov. 18	1893. Jan. 7	Coherent	Rec.	54	Infancy : 3 marks		Gastritis Nov. 28	13	—	—	9	2
25	E. P.	M.	4	„ 23	„ 16	„ 20	„ 20	„ 7	Confluent	„	53	*Unvaccinated*	Admitted for scarlet fever Oct. 28	Abscesses	—	—	—	—	—
26	F. H.	M.	8	„ 23	„ 18	„ 21	„ 23	„ 21	„	„	65	„		Keratitis; tonsilitis	14	—	3	3	2
27	W. Y.	M.	30	„ 25	„ 19	„ 23	„ 24	1892. Dec. 15	Mild	„	27	Infancy : 3 marks		Some doubt as to this being varicella	15	—	1	1	1
28	L. D.	F.	9	„ 26	„ 23	„ 25	„ 26	1893. Jan. 28	Confluent	„	67	*Unvaccinated*	Admitted for scarlet fever Oct. 27. Sent home Nov. 27.	Delirium; dusky rash	16	—	4	2	2
29	M. R.	F.	4	Dec. 4	„ 29	Dec. 1	Dec. 3	„ 28	„	„	61	„	Admitted for scarlet fever Oct. 28. Sent home Nov. 15.		17	1	2	2	2
30	A. J.	M.	7	„ 7	Dec. 2	„ 4	„ 6	1892. Dec. 15	„	Died	14	„	Admitted for scarlet fever Oct. 19. Sent home Nov. 29.	Laryngitis; broncho-pneumonia.	18	1	3	4	2
31	C. H.	M.	7	„ 9	„ 4	„ 5	„ 6	1893. Jan. 21	Discrete	Rec.	49	„	Brother to 26. Quarantine Nov, 23	Albuminuria	14	—	—	—	—
32	K. L.	F.	33	„ 10	„ 7	„ 9	„ 10	„ 7	„	„	32	Infancy : 3 marks	Mother to No. 23. Quarantine Nov. 19 to Dec. 1.	Swollen breast	12	—	—	—	—
33	W. J. S.	M.	13	„ 21	„ 10	„ 16	„ 21	Feb. 20	Confluent	„	73	*Unvaccinated*		Large pustules; abscesses.	19	—	2	2	2
34	H. J.	M.	8	„ 19	„ 11	„ 13	„ 17	„ 23	„	„	75	„		Delirium; abscesses	20	—	6	5	2
35	W. C.	M.	30	„ 16	„ 12	„ 15	„ 15	Jan. 10	Coherent	„	30	Infancy : 2 marks			—	—	—	—	—
36	W. R.	M.	36	„ 17	„ 12	„ 14	„ 17	„ 5	Mild	„	25	„ 3 „			17	—	—	—	—
37	E. P.	F.	25	„ 17	„ 15	„ 17	„ 15	„ 4	„	„	21	„ 3 „	Re-vaccinated (2 insertions) Dec. 15, 1892. Hospital nurse.	Eruption aborted	—	—	—	—	—
38	A. J. P.	M.	35	—	„ 15	„ 17	—	1892. Dec. 26	Discrete	„	12	„ ? „	Not notified		21	—	4	4	2
39	— L.	M.	1	1893. Jan. 2	„ 15	„ 15	—		Coherent	„	—	*Unvaccinated*			22	—	2	3	2
40	E. M.	F.	18	1892. Dec. 26	„ 20	„ 22	Dec. 24	1893. Jan. 28	Mild	„	40	Infancy : 3 marks		Menorrhagia	23	—	—	2	3
41	A. W.	F.	24	1893. Jan. 25	„ 23	?	1893. Jan. 25	Feb. 4	„	„	44	„ 2 „			24	—	2	2	—
42	F. S.	F.	22	1892. Dec. 30	„ 24	Dec. 26	„ 28	„ 28	Discrete	„	67	„ 2 „			25	—	1	3	—
43	G. L.	M.	4	1893. Jan. 1	„ 30	1893. Jan. 2	„ 2	„ 23	Coherent	„	56	*Unvaccinated*	Admission into Children's Hospital with convulsions, Jan. 1.	Abscesses	22	—	—	—	—
44	A. M. S.	F.	7	„ 3	„ 31	„ 2	„ 2	Jan. 16	Mild	„	17	Infancy : 4 marks		"Doubtful" case	19	—	—	—	—
45	N. H.	F.	12	„ 14	„ 31	„ 2	„ 12	Feb. 15	„	„	47	*Unvaccinated*	? Contracted from No.	Slight fever; tonsilitis.	26	—	2	5	2
46	C. G.	M.	24	„ 5	„ 31	„ 2	„ 3	Jan. 30	„	„	31	Infancy : 2 marks	Contracted at Halifax		27	—	3	4	2
47	F. L.	M.	25	„ 5	„ 31	„ 3	„ 5	March 11	Confluent	„	71	„ 3 „	Contracted at Chesterfield	Severe, but abortive	28	—	1	1	2
48	W. L.	M.	28	„ 6	1893. Jan. 1	„ 4	„ 5	Feb. 4	Mild	„	35	„ 2 „		Slight fever	22	—	—	—	—
49	A. B.	M.	15	„ 6	„ 1	„ 5	„ 8	„ 4	„	„	35	„ 3 „		Tonsilitis	29	—	—	4	2
50	E. H.	F.	21	„ 9	„ 2	„ 5	„ 7	Jan. 28	„	„	27	„ 3 „		No secondary fever	30	—	3	6	1
51	C. M.	F.	15	„ 5	„ 3	„ 5	„ 5	„ 28	„	„	26	„ ? „	Had slept with sister, No. 40, Dec. 19. Sent to quarantine Dec. 28.		23	—	—	—	—

TABLE OF CASES OF SMALL-POX—*cont.*

No.	me.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
52	. M.	F.	36	1893. Jan. 8	1893. Jan. 3	1893. Jan. 7	1893. Jan. 8	1893. Feb. 1	Mild	Rec.	30	Infancy: ? marks	Had slept with sister, No. 40, Dec. 19. Sent to quarantine Dec. 28.		23	—	—	—	—
53	B. P.	F.	8	„ 9	„ 3	„ 5	„ 11	March 29	Confluent	„	86	*Unvaccinated*	Infected by No. 38	Abscesses	21	—	—	—	—
54	J. B.	F.	8	„ 8	„ 3	„ 6	„ 8	„ 29	„	„	86	„		Semi-malignant; hæmorrhage; high fever.	31	—	1	1	4
55	. T.	M.	10	„ 23	„ 3	„ 5	„ 23	„ 11	Discrete	„	68	„	Not recognised at first		32	—	2	4	2
56	E. A.	M.	10	„ 7	„ 4	„ 6	„ 7	Feb. 23	„	„	51	„		Large pustules	33	—	1	2	1
57	A. P.	F.	13	„ 8	„ 4	„ 6	„ 8	„ 1	Mild	„	29	Infancy: 2 marks	Had nursed No. 43 when eruption on him.		34	—	3	3	2
58	J. M.	M.	19	„ 13	„ 4	„ 6	„ 13	„ 4	„	„	32	„ 4 „	About with rash out		35	—	—	6	2
59	J. S.	M.	5	„ 6	„ 4	„ 6	„ 6	March 15	Confluent	„	71	*Unvaccinated*		Nephritis; dropsy; tonsillitis.	19	—	—	—	—
60	E. M.	F.	28	„ 6	„ 5	„ 7	„ 8	Jan. 23	Mild	„	19	Infancy: 5 marks	Re-infected (*vide* No. 111)	No pyrexia; miscarriage.	36	—	4	1	1
61	E. P.	F.	5	„ 9	„ 5	„ 7	„ 10	Jan. 20	Confluent	Died	16	*Unvaccinated*	Infected by No. 38	Hæmorrhages. Double panopthalmitis.	21	—	—	—	—
62	B. K.	F.	26	„ 9	„ 5	„ 8	„ 8	Feb. 8	Mild	Rec.	32	Infancy: 4 marks	Wife of keeper of common lodging-house.		—	—	—	—	—
63	V. G.	F.	22	„ 11	„ 5	—	—	—	Discrete	„	—	„	Infected by No. 38		37	—	—	5	2
64	E. H.	F.	14	„ 13	„ 6	Jan. 9	Jan. 12	March 8	Confluent	„	62	*Unvaccinated*			26	—	—	—	—
65	C. W.	M.	1½	„ 25	„ 6	„ 10	„ 25	Feb. 4	Mild	„	30	„	Not attended by medical man		24	—	—	—	—
66	M. V.	F.	20	„ 10	„ 7	„ 9	„ 8	March 16	Discrete	„	69	Infancy: 4 marks	Wardmaid at hospital. Refused re-vaccination.		—	—	—	—	—
67	A. W.	F.	20	„ 11	„ 7	„ 9	„ 11	Feb. 1	Mild	„	26	„ 4 „	Infected by No. 38		21	—	—	—	—
68	F. F.	M.	29	„ 18	„ 7	„ 9	„ 18	„ 11	„	„	36	„ 2 „	Came from workhouse		—	—	—	—	—
69	J. W.	M.	13	„ 13	„ 7	„ 11	„ 13	March 11	Confluent	„	64	*Unvaccinated*			38	—	3	3	2
70	G. L.	M.	23	„ 10	„ 8	„ 9	„ 10	Feb. 25	Coherent	„	49	Infancy: 4 marks		Tonsilitis; phlebitis	39	—	—	4	—
71	J. W.	M.	5	„ 11	„ 8	„ 10	„ 11	March 3	„	„	55	*Unvaccinated*		Slight delirium	40	—	3	1	1
72	J. J. J.	M.	8	„ 29	„ 9	„ 11	„ 31	Feb. 15	Discrete	„	38	„	Not recognised when sent to quarantine, 28th Jan.; had stains of recent rash. Brother to No. 104.		41	—	3	3	1
73	S. C.	M.	5	„ 12	„ 9	„ 10	„ 12	March 8	Coherent	„	59	„		Abscess; slight fever	42	—	4	—	3
74	E. B.	F.	17	„ 14	„ 9	„ 12	„ 15	Feb. 1	Mild	„	24	Infancy: 3 marks			43	—	4	5	2
75	T. H.	M.	21	„ 23	„ 9	?	—	—	Discrete	„	—	„ 3 „	Treated at home. Not discovered for 3 weeks.		44	—	1	6	
76	G. H.	M.	26	„ 13	„ 9	„ 11	Jan. 13	Feb. 4	Mild	„	27	„ 4 „			45	1	2	2	1
77	M. J.	F.	13	Feb. 5	„ 10	„ 12	—	—	Discrete	„	—	*Unvaccinated*	Not notified at first. Isolated at home. Home under observation till December 31.		20	—	—	—	—

TABLE OF CASES OF SMALL-POX—*cont.*

No.	Name.	Sex	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
78	G. S.	M.	50	1893. Jan. 18	1893. Jan. 12	1893. Jan. 14	1893. Jan. 18	1893. Feb. 4	Mild	Rec.	27	Infancy: 3 marks	Had matured before admission	- - - -	—	—	—	—	—
79	W. P. P.	M.	30	„ 13	„ 12	—	—	—	„	„	—	- - - -	- - - -	- - - -	46	—	1	3	1
80	G. G.	M.	44	„ 18	„ 13	„ 15	Jan. 17	Feb. 20	„	„	39	Infancy: 3 marks	- - - -	Spots fading 19 Jan.	47	—	—	—	—
81	A. B.	F.	24	„ 18	„ 15	„ 17	„ 18	„ 18	„	„	35	„ 4 „	Re-vaccinated unsuccessfully Jan. 9	About 6 papules	29	—	—	—	—
82	R. H.	F.	5	„ 18	„ 16	„ 18	„ 18	March 8	Coherent	„	52	*Unvaccinated*	Sent to quarantine 12th Jan.	- - - -	26	—	—	—	—
83	C. M.	M.	20	„ 22	„ 16	„ 18	„ 22	Feb. 20	Mild	„	36	Infancy: 5 marks	- - - -	- - - -	48	—	—	2	1
84	H. M.	F.	30	„ 20	„ 17	„ 19	„ 19	March 8	Coherent	„	51	„ 6 „	Sister to F. L., No. 47	Severe, but did not pustulate.	28	—	—	—	—
85	E. H.	F.	10	„ 18	„ 17	„ 19	„ 20	Feb. 23	„	„	38	*Unvaccinated*	Sent to quarantine 12th Jan.	- - - -	26	—	—	—	—
86	R. H.	M.	20	„ 23	„ 17	„ 19	„ 23	„ 23	Discrete	„	38	Infancy: 3 marks	- - - -	Developed scarlet fever, 26th Jan.	49	—	1	6	2
87	A. H.	F.	17	„ 18	„ 17	„ 19	„ 19	March 8	Coherent	„	51	*Unvaccinated*	Sent to quarantine 12th Jan.	Large bullæ	26	—	—	—	—
88	L. C.	M.	8	„ 25	„ 17	„ 19	„ 24	April 15	Confluent	„	89	„	- - - -	Delirium; abscesses	50	—	3	3	2
89	H. A.	M.	7	„ 20	„ 18	„ 20	„ 20	„ 29	Coherent	„	102	„	Desquamating (scarlet fever) on admission.	Slight delirium	33	—	—	—	—
90	G. R. T.	M.	21	„ 23	„ 18	„ 20	„ 23	Feb. 11	Mild	„	25	Infancy: 2 marks	Infected by brother, No. 55	- - - -	32	—	—	—	—
91	M. T.	F.	16	„ 23	„ 18	„ 20	„ 23	April 20	Mild	„	93	„ 2 „	Infected by No. 55	Mammary abscess	32	—	—	—	—
92	S. M.	M.	52	„ 22	„ 19	„ 21	„ 22	March 11	Coherent	„	52	„ 6 „	Infected by No. 51. In quarantine 5th to 12th Jan.	- - - -	23	—	—	—	—
93	N. T.	M.	4	„ 23	„ 19	„ 21	„ 23	April 20	Confluent	„	72	*Unvaccinated*	Infected by brother, No. 55	- - - -	32	—	—	—	—
94	M. N.	F.	41	„ 21	„ 19	„ 21	„ 21	March 8	Discrete (severe)	„	49	Infancy: 3 marks	Attended on Nos. 53, 57, 61	Marked eruption; course mild.	21	—	—	—	—
95	A. H.	F.	9 months.	„ 21	„ 19	—	—	Jan. 20	Malignant	Died	2	*Unvaccinated*	Died after 24 hours' attack	- - - -	51	1	—	3	—
96	E. W.	M.	2½	„ 25	„ 20	„ 23	„ 25	May 2	Confluent	Rec.	103	„	- - - -	Very severe	24	—	—	—	—
97	E. B.	F.	7	„ 21	„ 20	„ 21	„ 21	Feb. 23	Mild	„	35	„	- - - -	- - - -	52	1	3	3	2
98	J. W.	M.	28	„ 25	„ 20	„ 22	„ 25	„ 11	„	„	23	Infancy: 5 marks	Infected by his child, No. 65	- - - -	24	—	—	—	—
99	W. J.	M.	61	„ 27	„ 21	„ 23	„ 27	„ 20	„	„	31	„ 6 „ Re-vaccinated 1852.	- - - -	About six papules	—	—	—	—	—
100	A. W.	M.	17	„ 25	„ 22	„ 24	„ 25	March 11	„	„	49	Infancy: 4 marks	- - - -	- - - -	53	—	1	4	2
101	L. T.	F.	7	„ 24	„ 22	„ 24	„ 24	April 20	Discrete	„	89	*Unvaccinated*	Sister to No. 93	Slight fever	32	—	—	—	—
102	C. B.	M.	31	„ 25	„ 22	„ 24	„ 25	Feb. 22	Mild	„	32	Infancy: 4 marks. Revaccinated 1885.	- - - -	Rapid subsidence	54	—	4	2	1
103	J. P.	M.	33	„ 26	„ 22	„ 24	„ 25	March 11	Coherent	„	49	Infancy: 3 marks	- - - -	Slight fever; conjunctivitis; iritis.	55	1	2	1	1
104	C. J.	F.	5	„ 29	„ 23	„ 25	„ 28	April 6	Discrete	„	74	*Unvaccinated*	Sister to 72	Sloughing phenyitis	41	—	—	—	—
105	A. G.	F.	12	„ 26	„ 23	„ 25	„ 26	March 15	Confluent	„	52	„	- - - -	Hæmatemesis; epistaxis; fever.	56	—	—	1	1

TABLE OF CASES OF SMALL-POX—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
106	E. W.	F.	40	1893. Jan. 28	1893. Jan. 23	1893. Jan. 25	1893. Jan. 25	1893. Feb. 22	Mild	Rec.	31	Infancy: 3 marks. Re-vaccinated ten years ago.	Nursed No. 60 at hospital		—	—	—	—	—
107	T. H. W.	M.	21	„ 28	„ 26	„ 28	„ 28	„ 20	„	„	26	Infancy: 3 marks			—	—	—	—	—
108	A. P.	F.	14	„ 30	„ 27	„ 29	Feb. 1	March 15	„	„	48	„ 4 „		Complicated with otorrhea and symptoms of meningitis.	57	—	—	3	2
109	J. S.	M.	70	Feb. 4	„ 28	Feb. 1	„ 3	April 4	„	„	67	„ 4 „		Bronchitis	58	—	2	2	2
110	F. E. H.	F.	4	„ 3	„ 28	Jan. 31	„ 3	Feb. 8	Confluent	Died	12	*Unvaccinated*		Panopthalmitis	59	1	2	1	1
111	E. M.	F.	28	Jan. 30	„ 28	„ 30	Jan. 30	March 2	Discrete	Reo.	34	Infancy: 5 marks	No. 60 re-admitted	Well matured pustules on face.	36	—	—	—	—
112	J. R.	M.	29	„ 30	„ 28	„ 30	„ 30	„ 23	Confluent	„	55	„ 2 „		Alcoholic; erysipelas	—	—	—	—	—
113	A. P.	F.	24	Feb. 2	„ 29	Feb. 1	Feb. 1	„ 4	Mild	„	35	„ 2 „			60	1	7	8	3
114	N. J.	M.	5	„ 5	„ 30	„ 1	„ 4	„ 9	Confluent	Died	9	*Unvaccinated*		Dusky red rash	20	—	—	—	—
115	A. W.	F.	22	„ 9	„ 31	„ 2	„ 4	March 29	Discrete	Rec.	56	Infancy: 2 marks			61	—	—	2	—
116	W. K.	M.	28	„ 4	„ 31	„ 2	„ 4	„ 4	Mild	„	31	„ 3 „	Engaged on work at hospital 14th April.	Tonsilitis 7th Feb.	62	—	1	2	—
117	J. P.	M.	50	„ 4	„ 31	„ 2	„ 4	„ 11	Discrete	„	38	„ 4 „		Rash abundant on face and throat.	64	—	—	5	1
118	H. B.	M.	25	„ 4	Feb. 1	„ 3	„ 4	„ 4	Mild	„	32	Infancy: Re-vaccinated 2 years ago.		About six papules	—	—	—	—	—
119	M. C.	M.	16	„ 4	„ 2	„ 4	„ 4	Feb. 25	„	„	24	Infancy: 4 marks	Infected by No. 88		50	—	—	—	—
120	J. B.	M.	30	„ 9	„ 3	„ 6	„ 8	March 4	„	„	30	„ 5 „			63	1	2	1	1
121	B. G.	M.	7	„ 14	„ 4	„ 7	„ 11	April 27	Confluent	„	83	*Unvaccinated*		Abscesses	65	—	4	1	2
122	E. J.	F.	4	„ 8	„ 4	„ 6	„ 7	„ 27	Coherent	„	83	„		„	20	—	—	—	—
123	E. J.	M.	15	„ 8	„ 4	„ 6	„ 7	„ 6	„	„	62	„		„	20	—	—	—	—
124	L. C.	M.	35	„ 6	„ 4	„ 6	„ 6	Feb. 25	Mild	„	22	Infancy: 1 mark	Father to 88 and 119		50	—	—	—	—
125	A. L.	M.	48	„ 10	„ 6	„ 8	„ 9	March 4	„	„	27	„ 2 marks		Bronchitis	—	—	—	—	—
126	H. S.	F.	21	„ 11	„ 9	„ 11	„ 11	„ 2	„	„	22	„ 5 „	Infected by 104		41	—	—	—	—
127	M. S.	F.	33	„ 17	„ 11	„ 13	„ 17	„ 15	Discrete	„	33	„ 6 „	From Mansfield 11th Feb.		66	—	1	1	4
128	M. E. J.	F.	6	„ 17	„ 12	„ 14	„ 16	„ 29	Coherent	„	46	*Unvaccinated*		Abscesses	20	—	—	—	—
129	W. B.	M.	7	„ 17	„ 12	„ 14	„ 16	April 6	Confluent	„	54	„	? Infected in Sunday school	„	67	—	4	1	2
130	A. H.	F.	26	„ 18	„ 16	„ 18	„ 18	March 15	Mild	„	28	Infancy: 3 marks		Tonsilitis	59	—	—	—	—
131	N. G.	F.	5	„ 18	„ 16	„ 17	„ 18	April 20	Confluent	„	64	*Unvaccinated*		Abscesses	65	—	—	—	—
132	J. U.	M.	52	„ 27	„ 16	„ 18	„ 25	March 23	Mild	„	36	Infancy: 3 marks. Re-vaccinated 30 years.	For a week at C. L. H. with rash out		—	—	—	—	—

TABLE OF CASES OF SMALL-POX—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
133	J. T.	M.	2	1893. Feb. 25	1893. Feb. 18	1893. Feb. 21	1893. Feb. 23	1893. April 1	Coherent	Rec.	43	*Unvaccinated*		Bronchitis; pertussis	68	—	1	1	1
134	G. H.	M.	29	—	„ 21	„ 23	—	—	Mild	„	—	Infancy: 3 marks	Not recognised. At home		69	—	2	2	1
135	S. H.	F.	26	March 1	„ 25	„ 27	Feb. 27	May 9	Confluent	„	74	*Unvaccinated*		Severe delirium	70	—	3	2	—
136	T. B.	M.	44	„ 2	„ 27	March 1	March 2	March 25	Discrete	„	27	Infancy: 2 marks	Father to 129		67	—	—	—	—
137	M. R.	M.	31	„ 3	March 1	„ 3	„ 3	May 10	Confluent	„	71	„ 2 „	At Northampton 15th Feb.		71	—	—	—	—
138	E. S.	F.	7	„ 8	„ 1	„ 3	„ 6	April 29	Mild	„	60	*Unvaccinated*		Developed scarlet fever 17th March.	72	1	3	—	2
139	J. W.	M.	29	„ 7	„ 2	„ 6	„ 6	„ 22	Coherent	„	52	Infancy: 3 marks	Infected at Tipshelf, near Sheffield		73	—	3	5	2
140	J. C.	M.	26	„ 7	„ 3	„ 6	„ 6	„ 18	Discrete	„	47	„ „	Do. do. do.		73	—	—	—	—
141	G. T. H.	M.	39	„ 11	„ 5	„ 7	„ 11	„ 6	„	„	33	„ 5 „		Conjunctivitis	—	—	—	—	—
142	G. B.	M.	45	„ 13	„ 5	„ 8	„ 11	„ 1	Mild	„	28	„ 3 „			—	—	—	—	—
143	W. T.	M.	32	„ 10	„ 7	„ 9	„ 10	„ 1	„	„	26	„ 4 „			68	—	—	—	—
144	J. H. G.	M.	29	„ 11	„ 8	„ 10	„ 10	„ 29	Coherent	„	53	„ 3 „			—	—	—	—	—
145	J. F.	M.	48	„ 14	„ 8	„ 10	„ 10	„ 1	Discrete	„	25	„ 6 „		Slight fever	—	—	—	—	—
146	J. C.	M.	64	„ 14	„ 9	„ 11	„ 11	„ 14	„	„	37	„ 3 „		Delirium tremens	—	—	—	—	—
147	F. H.	M.	4	—	„ 11	?	—	—	„	„	—	*Unvaccinated*	All at home infected by 134		69	—	—	—	—
148	A. H.	F.	29	—	„ 13	?	—	—	Mild	„	—	Infancy: 4 marks			69	—	—	—	—
149	C. P.	F.	16	—	„ 19	?	—	—	„	„	—	Infancy			74	—	—	4	2
150	W. S.	M.	26	March 24	„ 21	March 23	March 23	April 18	„	„	29	Infancy: 4 marks			75	—	1	7	2
151	B. F.	M.	62	„ 29	„ 22	„ 24	„ 24	„ 18	Discrete	„	28	„ 2 „			—	—	—	—	—
152	G. H.	M.	1	—	„ 22	—	—	—	„	„	—	*Unvaccinated*	At home; infected by 134		69	—	—	—	—
153	J. W.	M.	30	—	„ 22	—	—	—	Mild	„	—	Infancy			69	—	—	—	—
154	J. F.	M.	27	March 30	„ 24	March 26	March 30	April 18	„	„	26	Infancy: 5 marks			—	—	—	—	—
155	W. H.	M.	28	„ 30	„ 26	„ 28	„ 29	„ 27	Confluent	„	33	*Unvaccinated*			70	—	—	—	—
156	F. P.	M.	23	—	„ 26	—	—	—	Mild	„	—	Infancy	At home; infected by 134		74	—	—	—	—
157	E. B.	M.	35	April 3	„ 27	March 29	April 3	April 29	Discrete	„	34	Infancy: 3 marks			76	—	3	1	1
158	H. B	F.	21	„ 16	„ 27	„ 29	„ 17	„ 18	Mild	„	23	„ 4 „	Infected by 134		77	—	1	4	3
159	M. W.	F.	33	„ 2	„ 28	„ 30	„ 1	„ 27	„	„	31	„ 2 „			78	—	4	1	2
160	F. W	F.	30	„ 2	„ 29	„ 31	March 31	May 9	Discrete	„	42	„ 2 „	? infected 15th March at hospital gate	Phlyctenula	70	—	1	1	2

Table of Cases of Small-pox—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
				1893.	1893.	1893.	1893.	1893.											
161	E. P.	F.	45	April 14	April 2	—	—	—	Mild	Rec.	—	Infancy	At home, 134; mother of 149 and 156		74	—	—	—	—
162	J. H.	M.	39	May 9	„ 2	April 4	May 9	May 13	Coherent	„	42	„ 2 marks	Not medically attended, but in bed 3 weeks.		80	—	1	1	1
163	H. H.	M.	9	April 8	„ 3	„ 5	April 9	„ 25	„	„	53	*Unvaccinated*	? infected at school		81	—	3	2	1
164	T. B.	M.	29	„ 22	„ 3	—	—	—	Mild	„	—	Infancy: 4 marks			82	—	3	2	—
165	E. G.	F.	45	„ 15	„ 4	—	—	—	„	„	—	„			83	1	3	—	3
166	E. M.	F.	21	„ 21	„ 5	April 7	—	—	„	„	—	„ 4 marks	Not notified at first		84	—	2	6	2
167	J. A.	M.	22	„ 14	„ 7	„ 9	April 13	May 2	„	„	26	„ 2 „	Infected by "T. S." a navvy	About 6 spots	85	—	—	2	3
168	L. B.	F.	8	„ 14	„ 8	„ 10	„ 12	„ 9	Coherent	„	32	*Unvaccinated*	Sister to No. 158		77	—	—	—	—
169	F. H.	M.	35	„ 14	„ 10	„ 12	„ 13	„ 20	Discrete	„	41	Infancy: 3 marks	Infected by "T. S."		85	—	—	—	—
170	M. H.	F.	29	„ 14	„ 10	„ 12	„ 15	„ 6	„	„	27	„ 2 „			85	—	—	—	—
171	A. M.	F.	10	„ 16	„ 10	„ 12	„ 16	„ 13	Mild	„	34	*Unvaccinated*	Grandchildren to 161	Mild attacks	86	1	2	1	2
172	F. M.	F.	8	„ 16	„ 10	„ 12	„ 16	„ 13	Discrete	„	34	„			86	—	—	—	—
173	J. G.	M.	7 months.	„ 15	„ 10	„ 12	„ 14	„ 20	Coherent	„	41	„		Spinal abscess	83	—	—	—	—
174	N. G.	F.	7 years.	„ 15	„ 10	„ 12	„ 14	June 27	Confluent	„	79	„		Hæmorrhagic rash; severe pitting; abscesses.	83	—	—	—	—
175	J. M.	F.	28	—	„ 10	—	—	—	Mild	„	—	Infancy	Thought to have "influenza"		87	1	1	2	1
176	N. B.	M.	33	April 14	„ 11	April 13	April 14	May 10	Discrete	„	30	„ 3 marks	Connected with 156, &c.		88	1	1	1	1
177	E. B.	F.	16	„ 16	„ 12	„ 14	„ 15	„ 9	„	„	28	„ 4 „			77	—	—	—	—
178	A. M.	F.	29	„ 16	„ 13	„ 15	„ 16	„ 25	Coherent	„	43	*Unvaccinated*	An equivocal scar on left arm. Infected by "T. S."		89	—	3	1	2
179	T. G.	M.	49	„ 17	„ 14	„ 16	„ 17	„ 10	Mild	„	27	Infancy: 3 marks; revaccinated 1887, *nil.*	Connected with 134, &c.		83	—	—	—	—
180	G. B.	M.	33	„ 19	„ 14	„ 16	„ 19	„ 10	Discrete	„	27	Infancy: 3 marks	Infected by "T. S."		90	—	4	1	2
181	W. D.	M.	20	„ 21	„ 16	„ 18	„ 19	July 1	Confluent	Rec.	77	Infancy: 1 mark	? Infected at athletic sports, 2nd April.	Abscesses; iritis	91	—	1	6	2
182	B. M.	F.	9	„ 21	„ 16	„ 18	„ 22	April 24	Malignant	Died	9	*Unvaccinated*	Sister to 166	Hæmorrhages all over body. Pulm. œdema.	84	—	—	—	—
183	L. B.	F.	8½	„ 22	„ 17	„ 19	„ 20	June 8	Discrete	Rec.	53	„	From father, who shows recent stains.	Ecthyma, 30th May	82	—	—	—	—
184	J. S.	M.	16	„ 23	„ 17	„ 19	„ 21	May 30	Confluent	„	44	„		Abscesses; severe pitting.	92	—	—	1	2
185	R. H.	M.	11	„ 23	„ 19	„ 21	„ 22	April 25	Malignant	Died	7	„	Infected by brother, 163	Hæmatemesis; epistaxis.	81	—	—	—	—
186	M. A. L.	F.	25	„ 28	„ 19	„ 21	„ 24	May 13	Mild	Rec.	25	Infancy: 4 marks	Probably by 166	Maturating on admission.	84	—	—	—	—
187	E. M.	M.	6	„ 23	„ 20	„ 22	„ 22	„ 31	Coherent	„	42	*Unvaccinated*	Infected by sister, 166	Abscesses; severe pitting.	84	—	—	—	—
188	H. L.	M.	3½	„ 29	„ 23	„ 26	„ 28	June 8	„	„	47	„		Slight fever and pitting.	93	—	3	—	2

TABLE OF CASES OF SMALL-POX—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
189	E. M.	F.	34	1893. April 28	1893. April 23	1893. April 25	1893. April 27	1893. May 25	Discrete	Rec.	33	Infancy: 3 marks	Mother to 171 and 172	About 6 papules	86	—	—	—	—
190	M. G.	F.	8	„ 29	„ 24	„ 26	„ 28	June 8	„	„	46	April 19, 1893: 3 vesicles.	Sister to 174	Very mild	83	—	—	—	—
191	H. B.	M.	13	May 2	„ 25	„ 27	„ 27	„ 10	Coherent	„	47	*Unvaccinated*	? Infected by calling at 162's house	Abscesses	94	—	3	3	2
192	S. B.	F.	56	—	„ 25	—	—	—	Mild	„	—	Infancy	Probably infected by daughter, 175	- - - -	95	—	—	6	2
193	L. M.	F.	3	May 2	„ 26	„ 28	May 2	May 25	Confluent	„	30	*Unvaccinated*	Child of 189	Abscesses; phthisis	86	—	—	—	—
194	G. B.	M.	16 months.	„ 1	„ 26	„ 28	April 29	„ 17	„	Died	22	„	Infected by father, 180	Double panopthalmitis; gangrene of legs.	90	—	—	—	—
195	E. B.	F.	18	„ 1	„ 27	„ 29	May 1	June 23	„	Rec.	58	„	Infected in country	Dusky rash; abscesses; severe pitting.	96	—	—	2	2
196	B. S.	F.	2	„ 9	„ 28	May 1	„ 9	„ 8	Coherent	„	42	„	Infected by father at T.	Abscesses	97	—	1	4	2
197	B. B.	F.	5	„ 3	„ 29	„ 1	„ 2	„ 25	Mild	„	58	„	- - - - - -	About 6 papules	82	—	—	—	—
198	L. B.	F.	3	„ 3	„ 30	„ 2	„ 2	„ 27	Confluent	Died	58	„	Infected by father, 180	Panophthalmitis; phagedæna of face.	90	—	—	—	—
199	E. H.	M.	16	„ 3	„ 30	„ 2	„ 3	„ 10	Discrete	Rec.	42	„	- - - - - -	- - - -	98	—	2	4	3
200	A. S.	F.	23	„ 5	May 1	„ 3	„ 2	May 15	Mild	„	15	Infancy: 4 marks	Wardmaid at Hospital. Not re-vaccinated.	About 6 papules; hysteria.	—	—	—	—	—
201	A. M.	F.	22	„ 8	„ 2	„ 4	„ 6	„ 31	„	„	30	„ 2 „	At work with 166	About 6 papules	99	—	3	8	2
202	E. H.	F.	36	„ 8	„ 3	„ 5	„ 6	June 20	Coherent	„	49	„ 3 „	? Infected at 162's house	- - - -	100	—	—	1	2
203	A. G.	M.	26	„ 10	„ 5	„ 7	„ 10	„ 3	Discrete	„	30	„ 3 „	Assisted at burial of 182	? Inoculated	101	1	—	2	2
204	J. B.	M.	60	June 3	„ 6	„ 8	June 3	„ 17	„	„	43	„ 2 „	Husband to 192	Not diagnosed when ill.	95	—	—	—	—
205	T. B.	M.	40	May 18	„ 8	„ 10	May 16	May 30	Mild	„	23	„ 3 „	- - - - - -	Maturating on admission.	102	—	1	4	2
206	W. T.	M.	50	„ 15	„ 8	„ 10	„ 15	June 3	„	„	27	„ 3 „	- - - - - -	- - - -	103	—	—	1	2
207	H. W.	M.	23	„ 12	„ 8	„ 10	„ 11	„ 17	Coherent	„	41	„ 3 „	? Infected through "T. S."	- - - -	104	—	—	7	2
208	W. V.	M.	6	„ 17	„ 10	„ 12	„ 15	„ 20	Confluent	„	42	*Unvaccinated*	? Infected by 196	Abscesses; corneal ulcer.	105	—	2	3	2
209	J. B.	M.	10	„ 14	„ 10	„ 12	„ 12	„ 23	Coherent	„	45	„	Infected by brother, 191	Abscesses; pitting	94	—	—	—	—
210	G. C.	M.	34	„ 16	„ 10	„ 12	„ 15	„ 3	Mild	„	25	Infancy: 3 marks	Assisted No. 203	Maturating on admission. About 6 pustules.	106	—	3	—	2
211	H. W.	M.	17	„ 15	„ 10	„ 12	„ 13	July 5	Confluent	„	57	*Unvaccinated*	? Infected at Sunday school	Abscesses; severe pitting.	107	—	—	2	2
212	C. M.	M.	7	„ 18	„ 11	„ 13	„ 17	June 30	Coherent	„	51	„	Not traced	- - - -	108	—	4	1	2
213	K. G.	F.	10	„ 17	„ 11	„ 13	„ 16	„ 23	Discrete	„	44	„	- - - - - -	- - - -	109	1	1	2	4
214	A. G.	F.	5	„ 17	„ 11	„ 13	„ 17	„ 17	„	„	38	„	- - - - - -	Diagnosis "doubtful." Placed in separate ward.	110	—	2	3	2
215	A. P.	M.	16	„ 16	„ 11	„ 13	„ 15	„ 28	Confluent	„	49	„	- - - - - -	Abscesses	111	—	3	4	2

TABLE OF CASES OF SMALL-POX—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
216	J. W.	M.	5	1893. May 17	1893. May 11	1893. May 13	1893. May 16	1893. June 8	Mild	Rec.	29	*Unvaccinated*	Desquamating from scarlet fever on admission.		112	—	3	1	2
217	H. S.	M.	37	„ 16	„ 13	„ 15	„ 16	„ 28	Confluent	„	47	Infancy: 3 marks	"T. S." lodged with him, 24th April to 15th May.	Broncho-pneumonia; delirium tremens.	104	—	—	—	—
218	W. B.	M.	6	„ 16	„ 13	„ 15	„ 15	„ 23	Discrete	„	42	*Unvaccinated*	Brother to 191	Abscesses	94	—	—	—	—
219	W. S.	M.	16	„ 20	„ 17	„ 19	„ 20	„ 28	Mild	„	43	May 16th, 1893: 2 vesicles.		„	104	—	—	—	—
220	W. H.	M.	44	„ 22	„ 17	„ 19	„ 20	„ 3	„	„	18	Infancy: 2 marks	Father to 199		98	—	—	—	—
221	A. H.	F.	21	„ 27	„ 18	„ 20	„ 26	„ 8	„	„	22	„ 1 „	Probably infected by nurse from scarlet fever hospital.	A few papules	113	—	—	6	1
222	E. S.	F.	16	„ 23	„ 19	„ 21	„ 22	„ 30	Confluent	„	43	*Unvaccinated*	From 196, her niece	Abscesses; deep pitting.	97	—	—	—	—
223	J. S.	M.	12	„ 23	„ 19	„ 21	„ 22	July 5	Coherent	„	48	„			97	—	—	—	—
224	W. B.	M.	12	„ 24	„ 20	„ 22	„ 23	June 24	Confluent	„	36	„			114	—	5	3	2
225	F. J.	M.	5	„ 27	„ 20	„ 22	„ 26	July 4	„	„	46	„	Newfoundpool case	Dysenteric attack; abscesses.	115	—	4	2	2
226	M. H.	F.	7	„ 29	„ 21	„ 23	„ 29	June 20	Discrete, m.	„	31	„	Not traced		116	1	2	2	2
227	S. M.	F.	37	„ 29	„ 21	„ 23	„ 29	„ 16	Mild	„	27	Infancy: 4	„	Very mild	117	—	1	4	5
228	A. G.	F.	12	June 1	„ 24	„ 26	„ 31	July 4	Confluent	„	42	*Unvaccinated*	Probably infected at inn at T.	Abscesses	118	—	2	1	3
229	S. D.	F.	24	„ 18	„ 24	—	—	—	Mild	„	—	Infancy: 4 marks	Thought to be varicella		119	—	—	2	—
230	E. W.	F.	30	„ 2	„ 25	May 27	June 1	July 4	Discrete, m.	„	41	„ „		About 6 papules	120	—	3	—	2
231	J. H. H.	M.	11	„ 2	„ 26	„ 28	„ 1	„ 8	Mild	„	44	„ „			121	—	4	1	2
232	L. P.	F.	8	„ 2	„ 27	„ 29	„ 3	„ 4	Confluent	„	39	*Unvaccinated*	Not traced		122	—	1	2	3
233	H. H.	M.	8	„ 2	„ 27	„ 29	„ 2	„ 4	Coherent	„	39	„	Probably infected by 213		123	—	4	—	4
234	S. P.	M.	42	„ 2	„ 27	„ 29	May 31	„ 28	Confluent	„	63	„	Probably infected at S. Wigston	High fever; delirium; abscesses.	124	—	1	5	2
235	J. W. S.	M.	39	„ 3	„ 27	„ 29	June 2	„ 5	Discrete	„	40	Infancy: 3 marks	„ „		125	—	—	2	3
236	J. N.	M.	28	„ 1	„ 28	„ 30	May 31	June 8	Malignant	Died	12	*Unvaccinated*	? At Sewer Works	Hæmorrhages	126	1	2	5	1
237	J. M.	M.	25	„ 2	„ 28	„ 30	June 1	July 14	Coherent	Rec.	48	At 10 years: 5 marks		Abscesses; marked pits.	87	—	—	—	—
238	E. G.	M.	4 months.	„ 3	„ 29	„ 31	„ 2	June 23	„	„	26	*Unvaccinated*	From sister 213	Pertussis. Slight pitting.	109	—	—	—	—
239	E. C.	F.	10	„ 2	„ 29	„ 31	„ 1	July 4	„	„	37	„	Probably by 212		127	1	2	3	2
240	J. W.	M.	30	„ 3	„ 30	June 1	„ 2	June 17	Discrete, m.	„	19	Infancy: 2 marks	By son, 216	About 12 papules	112	—	—	—	—
241	G. W. R.	M.	21	—	„ 30	May 31	—	„ 8	„ m.	„	—	„ 4 „	Thought to be varicella		128	—	3	4	2
242	N. H.	F.	19	June 5	„ 31	June 2	June 3	„ 27	„ m.	„	28	„ 5 „	Not traced	About 12 papules	129	—	—	3	2
243	A. G.	F.	52	„ 5	June 1	„ 3	„ 6	„ 30	Coherent	„	30	„ 3 „	Infected by 204		130	—	—	2	2

Table of Cases of Small-pox—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	·8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
244	R. H.	M.	48	1893. June 6	1893. June 1	1893. June 3	1893. June 6	1893. July 14	Confluent	Rec.	44	Infancy: 3 marks	By daughter, 221	Delirium tremens; albuminuria.	113	—	—	—	—
245	E. H.	F.	18	„ 6	„ 2	—	—	—	Mild	„	—	„ 3 „	Same family as 221		113	—	—	—	—
246	E. H.	F.	16	„ 6	„ 4	June 6	June 6	June 20	„	„	17	„ 3 „			113	—	—	—	—
247	G. H.	M.	13	„ 10	„ 4	„ 6	„ 9	„ 24	„	„	21	„ 4 „		About 6 papules	113	—	—	—	—
248	P. H.	M.	15	„ 13	„ 4	—	—	—	„	„	—	„ 2 „			113	—	—	—	—
249	A. A.	F.	27	„ 12	„ 7	June 9	June 11	June 30	Discrete	„	24	„ 5 „	Infected by 227		131	—	3	2	1
250	G. P.	F.	14	„ 11	„ 7	„ 9	„ 11	„ 27	Mild	„	21	„ 1 „	Visited H. family (204, &c.) on 25th May.	About 6 papules	132	—	2	2	2
251	W. A.	M.	28	„ 14	„ 8	„ 10	„ 12	July 22	Coherent	„	45	*Unvaccinated*	Work with 220		133	—	2	2	—
252	N. W.	M.	5	„ 12	„ 8	„ 10	„ 12	„ 18	Discrete	„	41	„	Infected by mother, 230	Abscesses; slight pitting.	120	—	—	—	—
253	W. W.	M.	34	„ 12	„ 9	„ 11	„ 12	„ 1	„ m.	„	23	Infancy: 3 marks	By wife, 230	About 6 papules	120	—	—	—	—
254	T. R. R.	M.	20	„ 15	„ 10	„ 12	„ 14	Aug. 9	Confluent	„	61	*Unvaccinated*		Dusky rash; abscesses	134	—	1	6	2
255	G. D.	M.	24	„ 18	„ 10	„ 12	„ 17	July 1	Mild	„	22	Infancy: 4 marks	Husband to 229	About 6 papules	119	—	—	—	—
256	E. B.	F.	17	„ 14	„ 11	„ 13	„ 13	„ 15	Confluent	„	35	„ 3 „			135	—	4	4	3
257	K. R.	F.	14	„ 17	„ 11	„ 13	„ 15	„ 4	Discrete	„	24	„ 1 „	Sister to 241		128	—	—	—	—
258	A. E. M.	F.	18 months.	„ 14	„ 11	„ 13	„ 13	Aug. 8	Confluent	„	59	*Unvaccinated*	Infected by father, 237		87	—	—	—	—
259	E. W.	F.	34	„ 18	„ 12	„ 14	„ 16	July 7	Discrete	„	26	Infancy	Newfoundpool case		136	—	1	1	2
260	C. B.	M.	10	„ 15	„ 12	„ 14	„ 15	„ 22	Coherent	„	41	*Unvaccinated*	Notified as scarlet fever	Abscesses	137	—	2	3	1
261	E. W.	F.	3½	„ 15	„ 12	„ 14	„ 15	„ 18	Confluent	„	37	„		Laryngitis; otitis; abscesses.	120	—	—	—	—
262	A. R.	F.	2	„ 17	„ 13	„ 15	„ 16	Aug. 8	„	„	57	„	Sisters to 241	Abscesses	128	—	—	—	—
263	E. R.	F.	21	„ 21	„ 13	„ 15	„ 19	July 4	Mild	„	22	Infancy: 4 marks		Very mild	128	—	—	—	—
264	G. C.	M.	3	„ 17	„ 13	„ 15	„ 17	„ 20	Discrete	„	38	*Unvaccinated*	Brother to 228		127	—	—	—	—
265	W. B.	M.	13	„ 17	„ 13	„ 15	„ 16	Aug. 1	Confluent	„	50	„	? Infected by visit to 253	Abscesses	135	—	—	—	—
266	E. B.	F.	7	„ 17	„ 13	„ 15	„ 17	July 25	„	„	43	„		„	138	—	1	2	1
207	H. R.	M.	8	„ 20	„ 14	„ 16	„ 19	„ 4	Mild	„	21	Infancy: 4 marks	Same family as 241	Very slight cases and put in isolation ward.	128	—	—	—	—
268	E. R.	M.	12	„ 20	„ 14	„ 16	„ 19	„ 4	„	„	21	„ 3 „			128	—	—	—	—
269	E. O.	F.	14	„ 21	„ 15	„ 17	„ 20	„ 20	Discrete	„	36	„ 2 „		Slight pitting	139	—	—	4	2
270	G. R.	M.	51	„ 20	„ 15	„ 17	„ 19	„ 8	„ m.	„	24	„ 2 „	Father to 241		128	—	—	—	—

TABLE OF CASES OF SMALL-POX—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households.	All Inmates.			
															Ref. No.	Under 1 Year.	1 to 10.	10 to 39.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
271	L. L.	M.	5	1893. June 19	1893. June 15	1893. June 17	1893. June 19	1893. Aug. 1	Confluent	Rec.	48	*Unvaccinated*	-	Abscesses	140	—	3	4	2
272	A. P.	F.	39	„ 20	„ 16	„ 18	„ 19	July 13	Discrete	„	28	Infancy : 3 marks	Infected by 232	-	122	—	—	—	—
273	M. R.	F.	7	„ 20	„ 17	„ 19	„ 19	„ 18	„	„	32	*Unvaccinated*	Same family as 241, &c.	Abscesses	128	—	—	—	—
274	D. L.	M.	5	„ 20	„ 17	„ 19	„ 20	Aug. 15	Confluent	„	60	„	Newfoundpool case	Abscesses ; pneumonia ; severe pitting.	141	—	3	1	2
275	H. U.	M.	25	„ 21	„ 18	„ 20	„ 20	July 19	Coherent	„	32	Infancy : 1 mark	„ „	Gastric catarrh	142	—	—	3	—
276	A. M.	F.	36	„ 23	„ 18	„ 20	„ 21	„ 11	Discrete, m.	„	24	„ 3 „	„ „	-	143	—	3	1	1
277	H. L.	M.	20	„ 28	„ 19	„ 21	„ 25	„ 14	„ m.	„	26	„ 3 „	-	About 12 papules	144	—	1	5	2
278	G. T.	M.	18	„ 26	„ 19	„ 21	„ 23	„ 8	Mild	„	20	„ 5 „	Newfoundpool case	-	145	—	—	8	1
279	S. B.	F.	42	„ 24	„ 19	„ 21	„ 23	„ 7	„	„	19	*Unvaccinated*	„ „	Had small-pox 40 years ago (pitted). Present attack about 6 papules.	146	—	—	1	2
280	T. O.	M.	26	„ 26	„ 21	„ 23	„ 25	„ 1	„	„	11	Infancy : 4 marks	„ „	About 6 papules	147	—	—	3	2
281	G. B.	F.	6	„ 27	„ 22	„ 24	„ 25	„ 18	Discrete, m.	„	27	*Unvaccinated*	„ „	About 24 papules	148	—	3	1	1
282	E. L.	F.	8	„ 24	„ 22	„ 24	„ 24	Aug. 1	Confluent	„	41	„	Sister to 274	Very severe ; abscesses	141	—	—	—	—
283	E. A. G.	F.	6	„ 27	„ 23	„ 25	„ 27	July 13	Mild	„	21	„	Newfoundpool case	Very mild	149	1	3	—	2
284	G. P.	M.	22	„ 28	„ 23	„ 25	„ 27	„ 19	Discrete, m.	„	27	Infancy : 4 marks	„ „	About 24 papules	150	—	1	1	2
285	J. B.	M.	43	July 1	„ 23	„ 26	„ 30	„ 14	Mild	„	22	„ 3 „	„ „ next door to 251	-	151	—	2	1	2
286	M. B.	F.	18	„ 1	„ 26	„ 28	July 1	„ 13	„	„	18	„ 3 „	Visited house in N. F. P., 13th June	About 12 papules	152	—	—	4	1
287	S. M.	F.	47	Aug. 1	„ 28	„ 30	„ 31	Aug. 22	Coherent	„	56	„ 2 „	-	Anomalous case (? not small-pox).	153	—	2	5	2
288	S. A. L.	F.	32	July 3	„ 29	July 1	„ 2	July 12	Confluent	Died	14	*Unvaccinated*	Infected by child 274	Dusky rash	141	—	—	—	—
289	E. L.	F.	3	„ 3	„ 29	„ 1	„ 2	„ 15	Mild	Rec.	17	„	Sister to 271. Desquamating from scarlet fever.	Scanty rash ; doubtful	140	—	—	—	—
290	E. C.	F.	7 months.	Aug. 8	„ 30	„ 2	„ 8	Aug. 3	Coherent	„	35	„	Newfoundpool case	At home 6 weeks	154	1	2	—	2
291	E. S. L.	M.	40	July 5	July 2	„ 4	„ 4	July 22	Discrete	„	21	Infancy : 3 marks. Revaccinated 1871.	Father of 271 and 289	About 36 papules	140	—	—	—	—
292	G. T.	M.	22	„ 11	„ 2	„ 4	„ 9	„ 22	Mild	„	21	Infancy : 2 marks	-	About 24 papules	155	—	—	1	2
293	A. W.	M.	10	„ 10	„ 4	„ 6	„ 9	Aug. 15	Coherent	„	43	*Unvaccinated*	Newfoundpool case	Large papule ; severe pitting.	156	—	4	5	2
294	E. A.	M.	23	„ 11	„ 5	„ 7	„ 11	„ 16	„	„	43	„	-	Bronchitis ; abscesses ; marked pitting.	157	—	3	3	2
295	C. P.	F.	29	„ 11	„ 6	„ 8	„ 10	„ 1	Mild	„	27	Infancy : 3 marks	Was near hospital 24th June	-	158	—	—	1	1

TABLE OF CASES OF SMALL-POX—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
296	W. S.	M.	11	1893. July 9	1893. July 6	1893. —	1893. —	1893. —	Mild	Rec.	—	*Unvaccinated*	Doubtful case. Varicella?		159	—	1	3	1
297	A. K.	F.	45	„ 11	„ 8	July 10	July 11	Aug. 22	Confluent	„	46	Infancy: 2 marks	Nursing patient who died from "typhoid" 24th June.		160	—	1	—	3
298	W. B.	M.	17	„ 13	„ 9	„ 11	„ 12	„ 2	Coherent, m.	„	25	„ 4 „	Newfoundpool case		161	—	—	4	2
299	W. A. C.	M.	3	Aug. 8	„ 14	„ 16	Aug. 8	„ 22	Confluent	„	40	*Unvaccinated*	Brother to 290	At home 4 weeks	154	—	—	—	—
300	E. F.	F.	20	„ 4	„ 22	„ 24	July 26	„ 8	Mild	„	18	Infancy: 4 marks	Newfoundpool case	About 6 papules	162	—	1	6	1
301	E. A. D.	F.	21	July 27	„ 22	„ 24	„ 27	„ 15	Discrete	„	25	„ 4 „	„ „		163	—	—	3	—
302	S. S.	M.	29	Aug. 4	„ 25	„ 27	Aug. 2	„ 16	Mild	„	23	„ 5 „	„ „	About 24 papules	164	1	1	3	—
303	C. G.	F.	25	„ 4	„ 25	„ 27	„ 4	„ 17	Discrete	„	24	„ 2 „	„ „	Lactation	165	—	2	2	2
304	C. P.	F.	20	July 29	„ 25	„ 27	July 29	„ 12	Mild	„	19	„ 4 „	„ „		166	—	—	3	1
305	M. A. E.	F.	31	„ 31	„ 26	„ 28	„ 31	„ 22	Coherent	„	28	„ 3 „			167	—	—	1	3
306	J. S.	M.	49	„ 30	„ 27	„ 29	„ 30	„ 19	„	„	24	„ 3 „	Newfoundpool case		168	—	—	4	2
307	K. S.	F.	30	Aug. 9	„ 28	„ 30	—	—	Mild	„	—				169	—	—	5	3
308	L. C.	F.	22	„ 13	„ 31	Aug. 2	Aug. 9	„ 22	Discrete	„	23	Infancy: 5 marks			170	1	—	2	—
309	E. J. C.	F.	2½	„ 5	Aug. 1	„ 3	„ 4	Oct. 7	Confluent	„	68	*Unvaccinated*		Abscesses; deep pitting	171	1	5	1	1
310	C. M. E.	F.	37	„ 14	„ 9	„ 11	„ 13	Aug. 24	Mild	„	16	Infancy, 4 marks. Re-vaccinated July 31.	One mark, sister to 305		167	—	—	—	—
311	E. H.	F.	8 months.	„ 16	„ 10	„ 12	„ 15	„ 22	Confluent	Died	13	*Unvaccinated*	? Infected by mother and wife (not reported).		172	1	1	1	—
312	G. O. H.	M.	26	„ 16	„ 10	„ 12	„ 15	„ 31	Mild	Rec.	22	Infancy: 2 marks	Ditto		172	—	—	—	—
313	E. S.	F.	6	„ 16	„ 12	„ 14	„ 15	Oct. 12	Confluent	„	62	*Unvaccinated*	Daughter to 302	Dusky rash; abscesses	164	—	—	—	—
314	A. H.	F.	24	„ 15	—	—	—	—	Mild	„	—	Infancy: ? 3 marks			173	—	—	2	1
315	E. T.	F.	9	„ 16	„ 13	„ 15	„ 17	Sept. 19	Discrete	„	38	*Unvaccinated*	Newfoundpool case	Probably infected by 290	174	—	3	5	1
316	C. T.	F.	4	„ 19	„ 16	„ 18	„ 19	„ 11	Confluent	Died	27	„	„ „	Hæmorrhages	174	—	—	—	—
317	E. H.	F.	8	„ 24	„ 21	„ 23	„ 24	„ 30	Discrete	Rec.	41	„		Slight pitting	175	—	2	1	2
318	M. J. C.	F.	22	Sept. 2	„ 26	„ 28	Sept. 2	„ 19	Mild	„	25	Infancy: 3 marks		Lactation	176	—	1	4	2
319	E. F.	F.	20	„ 7	„ 30	Sept. 1	„ 5	„ 19	„	„	21	„ 4 „	Newfoundpool case	About 12 papules	177	—	1	2	2
320	A. C.	F.	1 month.	„ 6	„ 31	„ 2	„ 3	„ 29	Confluent	„	30	*Unvaccinated*	„ „	Severe, but slight pitting.	178	1	2	1	1
321	O. K.	F.	9	„ 6	Sept. 3	„ 5	„ 6	Oct. 28	„	„	56	„		Conjunctivitis; otitis; abscesses.	179	1	2	3	2
322	F. W.	F.	12	„ 11	„ 6	„ 8	„ 11	„ 12	Discrete, m.	„	37	„		Mastoid abscess	180	—	3	3	2

TABLE OF CASES OF SMALL-POX—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
323	F. D.	F.	17	1893. Sept. 14	1893. Sept. 11	1893. Sept. 13	1893. Sept. 14	1893. Sept. 30	Mild	Rec.	20	Infancy: 4 marks			181	1	3	5	2
324	S. F.	F.	14	„ 14	„ 11	„ 13	„ 14	Oct. 21	Confluent	„	41	*Unvaccinated*	Infected by 318	Laryngitis	176	—	—	—	—
325	C. F.	F.	7	„ 14	„ 11	„ 13	„ 13	„ 28	„	„	48	„	„ „	Abscesses	176	—	—	—	—
326	E. R.	F.	19	„ 14	„ 11	„ 13	„ 13	Sept. 26	Mild	„	16	Infancy: 3 marks	„ „		176	—	—	—	—
327	E. F.	F.	10	„ 14	„ 12	„ 14	„ 14	„ 26	„	„	15	„ 4 „	„ „	6 papules	176	—	—	—	—
328	G. F.	F.	9	„ 20	„ 18	„ 20	„ 21	Dec. 1	Confluent	„	74	*Unvaccinated*	Infected by 319	Otitis; abscesses	177	—	—	—	—
329	M. W.	F.	10	„ 29	„ 20	„ 22	„ 23	Nov. 18	„	„	60	„	Sister to 329	Abscesses	180	—	—	—	—
330	A. B.	M.	28	„ 26	„ 20	„ 22	„ 24	Oct. 10	Mild	„	21	Infancy: 2 marks			182	—	1	2	1
331	F. L. C.	F.	18 months.	„ 27	„ 21	„ 23	„ 26	Nov. 2	„	„	43	*Unvaccinated*	Child of 313		183	—	1	2	1
332	M. A. W.	F.	45	„ 29	„ 21	„ 23	„ 24	Oct. 12	„	„	22	Infancy: 2 marks	Mother of 322		180	—	—	—	—
333	A. B.	M.	42	Oct. 13	Oct. 5	Oct. 7	Oct. 9	Nov. 4	„	„	31	„ 4 „		Conjunctivitis	184	—	3	4	2
334	J. A.	M.	17	Nov. 3	„ 6	„ 8	—	—	„	„	—	„ 3 „	Not admitted		185	—	2	5	2
335	A. S.	F.	22	„ 3	„ 9	„ 11	—	—	„	„	—	„ 3 „	„		186	—	1	5	—
336	E. B.	F.	28	„ 7	„ 10	„ 12	—	—	Discrete	„	—	„ 3 „	„		187	1	2	2	1
337	E. M.	F.	25	Oct. 19	„ 14	„ 16	Oct. 18	Nov. 2	Mild	„	20	„ 3 „		About 12 papules	188*	—	—	10*	1*
338	H. S.	M.	18 months.	Nov. 3	„ 20	„ 30	Nov. 3	Dec. 14	Confluent	„	56	*Unvaccinated*		Conjunctivitis; abscesses.	186	—	—	—	—
339	K. B.	F.	29	Oct. 31	„ 27	„ 29	Oct. 30	Nov. 10	„	Died	15	„		Hæmorrhages	189	—	2	2	—
340	E. A.	F.	10	Nov. 3	„ 28	„ 30	Nov. 1	Dec. 9	Discrete	Rec.	43	„		Abscesses	185	—	—	—	—
341	A. B.	M.	2	„ 7	Nov. 2	Nov. 4	„ 6	„ 22	Confluent	„	51	„	? From mother, 336	Conjunctivitis scesses,	187	—	—	—	—
342	E. A.	F.	8	„ 16	„ 13	„ 15	„ 16	„ 19	Coherent	„	37	„		Abscesses	185	—	—	—	—
343	S. T.	M.	18	„ 22	„ 16	„ 18	„ 21	„ 8	Mild	„	23	Infancy: 4 marks			190	—	—	4	2
344	J. B.	M.	35	„ 23	„ 20	„ 22	„ 23	Jan. 23	Confluent	„	65	„ 2 „			187	—	—	—	—
345	A. G.	M.	3 3	„ 23	„ 20	„ 22	„ 23	„ 13	„	„	55	„ 2 „			149	—	—	—	—
346	A. M.	F.	20	„ 27	„ 21	„ 23	„ 24	Dec. 16	Mild	„	26	„ 4 „	Influenza ? 8th Dec.		191	—	1	4	2
347	L. M.	F.	6	„ 27	„ 21	„ 23	„ 24	Jan. 5	Confluent	„	40	*Unvaccinated*	Newfoundpool case	Abscesses	192	—	2	2	1
348	A. R. R.	F.	7	„ 28	„ 22	„ 24	—	—	Malignant	Died	—	„	„ „	Convulsions; hæmorrhages.	193	1	3	3	2
349	A. S.	M.	19	Dec. 5	„ 27	„ 29	Nov. 30	Dec. 22	Discrete	Rec.	26	Infancy: 3 marks		Carbuncle, 9th Dec.	194	—	—	5	2
350	E. Y.	F.	42	„ 4	„ 30	Dec. 2	Dec. 3	Jan. 13	Coherent	„	44	„ 4 „	Newfoundpool case		195	—	1	1	3

* In this household there were also nine inmates whose age was not ascertained.

Table of Cases of Small-pox—*cont.*

No.	Name.	Sex.	Age.	Notification.	Onset.	Rash.	Admission to Hospital.	Termination.	Type of Attack.	Result.	Duration in Days.	Vaccination Data.	Remarks.	Clinical Features of Attack.	Households. All Inmates.				
															Ref. No.	Under 1 Year.	1 to 10.	10 to 30.	30 Years upwards.
Col. 1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.
351	M M. R.	F.	19	1893. Dec. 6	1893. Dec. 3	1893. Dec. 5	1893. Dec. 5	1893. Dec. 19	Mild	Rec.	17	Infancy: 4 marks	Infected by 348	Six papules	193	—	—	—	—
352	F. R.	F.	2	„ 6	„ 3	„ 5	„ 5	„ 7	Malignant	Died	5	*Unvaccinated*	„ „	Hæmorrhagic	193	—	—	—	—
353	A. M.	F.	27	„ 10	„ 6	„ 8	„ 8	Feb. 1	Confluent	Rec.	58	„	Infected by 347	Dusky rash; abscesses	192	—	—	—	—
354	M. Y.	F.	6	„ 14	„ 12	„ 14	„ 14	„ 1	„	„	52	„		Abscesses	195	—	—	—	—
355	W. G. C.	M.	6	„ 17	„ 12	„ 14	„ 16	Jan. 23	„	„	43	„	Infected by 350	„	196	1	3	2	2
356	A. R.	M.	11	„ 27	„ 18	„ 20	„ 26	„ 23	Discrete	„	37	„		„	197	—	4	5	2
357	H. M. F.	F.	20 months.	„ 25	„ 20	„ 22	„ 24	Feb. 1	Coherent	„	44	„		Otitis	198	—	1	—	3
														193 households		33	328	534	330 Age?-9

Note.—This list does not include the case of W.S, m., æt. 18, admitted into the small-pox hospital on April 18th, 1893, from the county (Thurmaston). He was unvaccinated, and had a severe (confluent) attack.

Eleven of these cases were unrecognised at the time of their illness, and were not notified to the authorities, viz., Nos. 38, 134, 147, 148, 149, 152, 153, 156, 175, 192, 241.

From this table it will be seen that of all the cases, 7 are assigned as malignant, 89 as confluent, 56 as coherent, 78 as discrete, and 127 as mild in type.

In his Report, Dr. Priestley points out that several others here termed "confluent" were malignant or quasi-malignant in character, viz., Nos. 3, 9, 15, 21, 26, 28, 30, 54, 61, 105, 110, 114, 135, 174, 194, 195, 198, 234, 254, 288, 309, 313, 316, 321, 325, 339, 353.

§ 9. *Summary of the outbreak.*

It is not my intention to enter into a detailed history of the outbreak, as that has been amply done by Dr. Priestley in the various reports he has presented to the Sanitary Committee, whilst the earlier stages of the epidemic were exhaustively inquired into and reported upon by a Special Committee. It may be useful if I present a summary of the whole outbreak month by month, completed by the after knowledge of all the available facts.

I propose, therefore, to mention in turn the fresh invasions of each household in each month, with brief reference to the ascertained sources of their infection and of the cases secondarily arising. In tabular form, the numbers of invaded houses per month are as follows:—

Month.	Number of Houses Invaded.	Numbers Attacked.	Cases arising in		
			Fever Hospital.	Work-house.	Lee Street Common Lodging-House.
1892.					
August - -	—	—	—	1	—
September -	3	5	—	1	—
October - -	3	3	7	—	1
November -	9	12	—	1	1
December - -	11	35	1	1	—
1893.					
January - -	35	46 (47*)	2	2	4
February - -	7	15	—	2	1
March - -	9	14	—	2	5
April - -	19	41	—	—	—
May - -	31	53	1	—	—
June - -	25	32	—	—	—
July - -	16	18	—	—	—
August - -	8	15	—	—	—
September -	5	7	—	—	—
October - -	6	11	—	—	—
November -	6	10	—	—	—
December - -	3	3	—	—	—
	196	323	11†	10	12

* One case re-admitted: apparently re-infected.
† This only includes those cases which arose in hospital and were not removed, but merely transferred to small-pox wards.

1892.

August.—On the 24th of this month, a tramp, W. S., who had been lodging in the town since the 21st, applied for admission to the workhouse infirmary. He had a scanty eruption, the nature of which was not recognised, and he was discharged on August 30. The subsequent occurrence of cases of small-pox in persons known to have been in his o. 1. company led to the discovery of this,—the first case known in this outbreak. He returned to Leicester some weeks afterwards, and, through Dr. Priestley's courtesy, I was able to see the man. He presented stains and traces of the eruption over the shoulders and on the forearms; and a smooth small cicatrix on the arm where he said that he had been vaccinated in infancy.

os. 2 and 3. *September.*—On the 4th, Mrs. M. (No. 2), and on the 5th, Mrs. B. (No. 3), who had been living in the lodging-house when W. S. stayed there, sickened: and on the 7th and 8th respectively the rash appeared. No. 2 was admitted into the hospital on September 9, and No. 3 on the 10th. The latter who was unvaccinated had a more severe attack than No. 2, who presented two vaccination scars. The husband and infant of No. 3 were taken into quarantine, and on leaving there on September 19th, the infant was taken charge of by some friends. This infant o. 5. (No. 5), was vaccinated when taken to quarantine, but about the 27th, developed a few equivocal spots. It is not unlikely that the child really had a very mild attack of variola, for two persons who nursed her after she had left os. 8 and 9. quarantine, developed the disease, viz.:—P. J. (No. 8) and E. R. (No. 9). In the one case the rash appeared on October 15, in the other on the 17th; both were confluent attacks, that of No. 9 (who was unvaccinated) being accompanied by hæmorrhages. An aunt of No. 9, M. S. (No. 18), who did not come into quarantine, sickened on No. 18. November 3, *i.e.*, 13 days after E. R.'s removal to hospital. No. 4 was an inmate of the ward in the No. 4. workhouse infirmary into which W. S. was sent on August 24 to 30th; he was suffering from syphilitic caries of the skull and was in a debilitated state. The rash of small-pox developed in him on September 9, and he died in the hospital in a confluent attack, on the 16th. It was not possible to obtain clear evidence of his having been vaccinated, but the fact that in early life he had been in the navy was held to be presumptive in favour of this.* Towards the end of the month, E. J. K. (No. 6), in the No. 6. employ of the Corporation was attacked. The origin of his illness is obscure but apparently the view that most commended itself to those in authority was that he may have been infected through contact with dry refuse which he was engaged in carting from the ashpit of an infected house. But whatever the source of his illness, it was the indirect cause of many cases of the disease that occurred in the following month. He was removed to the hospital on October 3rd, the day in which his rash appeared, and had a confluent attack, very severe at the outset, but rapidly drying up on maturation. He had four vaccination marks of infantile vaccination. At the same time that he was admitted, five other persons were taken to quarantine. One of these was his daughter, E. K. (No. 7), who was No. 7. forthwith vaccinated.

Outbreak in the Fever Wards.—The child E. K. had not been in quarantine nine days before she contracted scarlet fever. At this time the three fever wards were full of children in all stages, and the convalescent block (or old erysipelas ward) contained large numbers of convalescent. Indeed the accommodation of the building was strained to its utmost. E. K. was removed from the quarantine ward (9 in plan) to Ward I. This was on October 11th, and it so happened that a few days before this one or two of the fever patients had developed varicella. The only means of isolation left in the building were the small rooms at the entrances to wards I., II., and III., and it was into one of those that the cases of varicella were transferred. On October 15, *i.e.*, 12 days after her father developed the rash of small-pox and was removed to hospital, the child E. K., who, it may be recalled, was "undergoing vaccination," presented an eruption the characters of which were at first uncertain. The eruption was sparse, and the individual papules small, and although there was not an unanimous opinion as to its nature, yet in face of the fact that some of her ward mates had undoubted varicella, and from the lack of any other isolation accommodation, she was sent on October 15 to the small ward where three other varicella cases were, and indeed occupied a bed with one of them. Her case, however, did not run the course of varicella. On October 17 the three other children were removed from the small ward, and on October 19 E.K. was removed to the small-pox ward, there being no longer any doubt that she had contracted this disease from her father, and that its characters in her had been modified by her recent vaccination. She was then desquamating from scarlet fever. E. K., during the earlier period of her attack of small-pox, had thus been in Ward I. (full of scarlet fever cases) from October 14 (?) to October 15; and in Ward I. (annex) with three fever cases who had varicella from October 15 to October 17.

Of the 43 children suffering from scarlet fever in Ward I. when E. K. was an inmate, five developed small-pox. One of these, E. L. (No. 12), was probably infected before No. 12. admission on October 18th, as she sickened with small-pox on the 26th. Another, H. C. (No. 21), may have been No. 21. infected directly by No. 12, for she is said to have shared her bed on October 28th, *i.e.*, the day before the rash appeared in E. L. At any rate, H. C. fell ill on November 10th, *i.e.*, the 14th day of this possible exposure to infection. The infection of the three other children must, I believe, be attributed to contact with E. K., during the time that she was isolated with them for supposed varicella. That period of exposure, October 15 to 17, harmonises with the dates of their developing small-pox, viz.: G. B. (No. 11) on October 27, G. F. (No. 14) on Nos. 11, 14, October 29, and S. W. (No. 16) on October 29. 16.

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* As the case of W. H. (No. 4) excited much attention, especially, in regard to the question of his having been vaccinated and possibly re-vaccinated, it may be of interest to supplement the above brief statement with a record of the facts as elicited by the Special Committee which inquired into the origin of the small-pox outbreak. It appears that he was discharged from the navy on July 14, 1879, after having served for 14 years and 241 days. The order making re-vaccination compulsory in the navy was passed in 1871. His papers were produced before the Committee, but owing to their mutilated condition the record of his state as to vaccination had been effaced. We are then without any evidence of this, and hence this case has been classified as "vaccination doubtful or uncertain." *Vide* Minutes of Special Committee, pp. 382, 383.

—	Admitted for Scarlet Fever.	Ward.	Attacked with Varicella.	Sent Home from Hospital.	Small-pox.	
					Onset.	Rash.
No. 11, G. B.	Oct. 7 -	I.	Oct. 11 -	—	Oct. 27 -	Oct.
„ 12, E. L.	„ 18 -	I.	—	—	„ 26 -	„ 29
„ 14, J. F.	Sept. 15	I.	Oct. 10 -	—	„ 29 -	„ 31
„ 15, F. B.	Oct. 19 -	III.	—	—	„ 29 -	Nov. 1
„ 16, S.W.	Sept. 15	I.	Oct. 6 -	—	„ 30 -	—
„ 20, N.H.	About Sept. 20	?	„ 16* -	Oct. 21 -	Nov. 3 -	Nov. 5
„ 21, H. C.†	Oct. 4 -	I.	—	—	„ 10 -	„ 12
„ 23, R. L.	„ 15 -	III.	—	Nov. 9 -	„ 13 -	„ 16
„ 25, E. P.	„ 28 -	III.	—	—	„ 16 -	„ 20
„ 26, F. H.	„ 12 -	III.	—	Nov. 9 -	„ 18 -	„ 21
„ 28, L. D.	„ 27 -	II.	—	„ 21 -	„ 23 -	„ 25
„ 29, M. R.	„ 28 -	II.	—	„ 15 -	„ 29 -	Dec. 1
„ 30, A. J.	„ 19 -	III.	—	„ 29 -	Dec. 2 -	„ 4

* Placed in the Quarantine Ward which had been disinfected when the K. family left on October 15th.

† Said to have occupied same bed as E. L. (No. 12), on October 28th.

It is, however, impossible to ascribe the infection of all those who were attacked with small-pox whilst in the hospital to this origin. For eight other children, five in Ward III., two in Ward II., and one, placed in the quarantine ward, because of varicella in other parts of the building, contracted the disease. One of them, F. B. (No. 15), may, like No. 12, have been incubating small-pox when attacked with scarlet fever. The rest must have been infected in the hospital; how, it is only a matter of conjecture, but hardly of surprise, seeing that Ward III. is only distant a few yards from the small-pox wing which was then receiving patients. It may be, too, that N. H. (No. 20), who before leaving developed varicella, and was isolated in the quarantine ward just vacated by the family of E. K. (but thoroughly fumigated), was infected there. 3, 26, 30. She and five others were sent home, and had to be re-admitted with small-pox, which had appeared in them 13, 4, 9, 2, 14, and 3 days respectively, after leaving the hospital.

Lastly, in three instances the children infected other members of the family. R. L. (No. 23), who was sent home on November 9, and sickened with small-pox on the 13th, apparently infected his mother (No. 32), who developed small-pox in quarantine on December 1st,* F. H. (No. 26), who was sent home on November 9, and sickened with small-pox on the 18th, infected his brother (No. 31) with whom he slept, and who was attacked on December 4th, 12 days after No. 26 returned to the hospital. M. R. (No. 29), who was sent home, on November 15th, sickened with small-pox on the 29th, so that she probably was infected on leaving the hospital. She was re-admitted on December 1st, and her father, W. R. (No. 36), fell ill on the 12th, and had a very sparse papular eruption on the 14th; he was admitted on December 17th.

Thus, taking the whole series of cases which arose in the hospital wards or were connected with them, we find them ranging from September 15 to December 14, a period of two months.

The hospital was cleared of its scarlet fever inmates by October 31st, with the exception of a few who were too ill to leave.

It may be added that of these 158 scarlatinal cases 74 were found to be vaccinated; and 10 were vaccinated on the appearance of small-pox in the wards and within 24 hours of their return home. All the children attacked with small-pox were unvaccinated, and three of their number (13) died.

October.—On the 24th of this month a man (No. 10) was found in the streets with a maturating eruption. He was employed as a porter and lived at a common lodging-house. He had had some pain in the back on the 18th, but had not felt ill, and he first noticed a rash on the 21st. He was 57 years of age and had been vaccinated in infancy. The establishment accommodates 104 lodgers, and seems to be well managed. I had an opportunity of visiting it, and was informed that there were 85 to 90 "lodgers," several of whom were often absent at work for a week at a time. There is a large day room and kitchen on the ground floor, with lavatory and w.c. at the back; the upper floors being divided into cubicles for the inmates. This man had lived there for two years. When he first fell ill he was moved with his bed and bedding from his cubicle to a separate room. So far as could be ascertained (for in the interval some 12 or 14 had left) only one other inmate contracted **No. 19.** small-pox. This was W. R. (No. 19), who had occupied a cubicle in the same dormitory as No. 10. He was attacked on November 3, the rash appearing on the 5th. On the discovery of the first case the house was visited daily by the sanitary inspector. Re-vaccination was offered to the inmates, but none accepted it. Another case arising in **No. 13.** October was that of T. G. (No. 13), who had been employed at the hospital, part of his duty consisting in carrying coals into the wards. He had thus occasion to visit the small-pox wards daily; but had declined to be re-vaccinated. He was taken ill on the 27th; rash on 29th.

November.—On the 3rd of this month M. A. J., æt. 45 **No. 17.** (No. 17), who was employed in laundry work at the hospital, was attacked with confluent small-pox. She had possibly been infected through washing the clothes of N. H. (No. 20), who was leaving the hospital after her attack of varicella and was incubating small-pox. M. A. J. had declined to be re-vaccinated; and the severe form of her attack, which was characterised by delirium, and terminated fatally, may have been influenced by her acknowledged intemperate habits. On November 14 a labourer (No. 22) was sent on to **No. 22.** the hospital from the workhouse, having developed a small-pox rash on that day. He had probably contracted the disease outside Leicester. No. 24, a young man living in **No. 24.** Leicester, but not known to have been in contact with a case, developed a rash on November 16th, and was admitted on the 18th. He was a bicyclist, and possibly was infected in the neighbourhood of the town. The next case (No. 27) was one concerning which some difference of **No. 27.** opinion existed, the characters of the eruption being so much mortified. Its origin could not be traced.

December.—The following are the fresh infections occurring in this month and the cases connected with them:—W. J. S. (No. 33), a lad of 13, unvaccinated, was admitted **No. 33.** into hospital on the 21st; but he had been taken ill on the 10th, and had a copious rash, which developed into very large vesicles well out on the 16th. The case was at first unrecognised. He was no longer attending school, but lived in the Beatrice Road, the nearest part of the Newfoundpool district to the hospital, where later in the epidemic numerous cases arose. Two other cases occurred in this family, viz.:—Nos. 44 and 59, who sickened on December 31 and January **Nos. 44, 59.** 4, whilst a neighbour (No. 69) was attacked on January 7. **No. 69.** H. J., æt. 8 (No. 34), one of a family of 11 children, all **No. 34.** unvaccinated, whose ages ranged from one to 17 years, was attacked on the 11th; the rash appeared on the 13th, and the mother thinking it was "only measles," put him in a separate room and nursed him, not seeking medical advice until the 16th. How the child became infected is not known; inquiries were made at the school which he and five others attended, but no clue could then be obtained. This family was not sent into quarantine, but was visited daily for a fortnight by the inspector. Vaccination of the children was offered but refused by the parents. During the fortnight's surveillance, *i.e.*, up to December 31, no case was reported from this house. It was subsequently ascertained that one of the children had a few "spots"; and another was taken ill with vomiting and fever; but was well the next day. It was not until January 10th, 1893, *i.e.*, 24 days after the removal of No. 34, that another child, M. J., æt. 12 (No. 77), sickened. The parents con- **No. 77.** sidering this to be a case of chicken-pox did not inform the authorities, and kept her at home; but that the case was one of small-pox there can be no question not only from the preceding case, but from the fact that four other of the children were subsequently attacked, viz., N. J., æt. 5 (No. 114), on January 29th; E. J., æt. 4 (No. 122); on **Nos. 114, 122, 123, 128.** February 4; E. H. J., æt. 14 (No. 123), on February 4; and E. J., æt. 6 (No. 128), on February 12. If No. 77 were not infected from a case intermediate to her attack and that of No. 34, she may have been so through faulty disinfection of the house, or through the father visiting the hospital on January 27th, 28th, and 29th, owing to the critical state of the first child who was then in the ward. W. C., æt. 30 (No. 35), was sent on to the hospital from the **No. 35.** workhouse on December 15. He had been tramping to Leicester from Warwickshire during the past fortnight and arrived in the town with the rash out. No. 37 was a nurse **No. 37.** who had been in the service of the hospital since the beginning of October. She was attacked on December 15, and was re-vaccinated on the same day; the small-pox rash appeared on the 17th, and the attack was a very mild one. The next case in the record is that of A. J. P. (No. 38), **No. 38.**

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* There is some obscurity about this. December 1st was the 14th day of quarantine when No. 32 left; she says she was ailing then, but did not have any rash till December 9th or 10th. She may, therefore, have contracted the disease whilst in quarantine.

which, however, was not known to the sanitary authority until he was convalescent. It was then ascertained that a month previously, *i.e.*, on December 15, he had an attack of "lumbago" with fever, and kept to his house for nine days, a typical discrete rash having developed. This case was discovered owing to the admission to hospital in the beginning of January of three other members of the household, Nos. 53, 61. two (Nos. 53 and 61) being unvaccinated children, one of whom died after a most severe attack complicated with double panophthalmitis. No. 53 was attacked on January 3; No. 61 on January 5; and a maidservant (No. No. 67. 67) on January 7, she being re-vaccinated on the 10th, a No. 94. day after appearance of rash. The housekeeper (No. 94) who had attended on the children during the week of their illness that they were at home was not re-vaccinated with the rest of the family on January 10. She sickened on the 19th and was admitted on the 21st. Another case trace- No. 63. able to the same source is that of V. G. (No. 63), a young lady friend of No. 38, and visited by him when he was recovering from his attack. Her illness commenced on January 5; she was not removed to hospital.

Three members of another family, the source of whose infection was not ascertained, were attacked about this time. The first was an unvaccinated child, one year old No. 39. (No. 39), who was not attended by a medical man. His illness began on December 15. On January 2nd his brother No. 43. (No. 43) developed a rash, and the father (No. 48) on the No. 48. 8th. A woman (No. 57) who nursed the infant when it No. 57. was ill, sickened with small-pox on January 4. E. M., f., No. 40. æt. 15 (No. 40), vaccinated, had a suspicious rash on December 22nd; and was first isolated from the small-pox ward. On the 28th her family was removed to quarantine, Nos. 51, 52. and two of them (Nos. 51, 52) sickened with mild attacks of small-pox on January 3rd. The father's quarantine was prolonged for a week, when No. 51 was admitted into the small-pox ward on the 5th; but he also developed the No. 92. disease a week later, *i.e.*, on the 19th, or 14 days after his daughter was removed and 11 days after his wife had been. His attack was severe. Another family group of cases is that of the W's., living in Pool Road, Newfoundpool. Mrs. No. 41. W., æt. 24 (No. 41), had a mild attack commencing on December 22. She was not taken to the hospital then, but went there with her infant on January 25, he having been No. 65. attacked (No. 65) on January 6. The remaining members of Nos. 96 and 98. the family—E. W., æt. 2½ (No. 96), and Mr. W. (No. 98)—were removed at the same time, having been attacked on the 20th. The children were unvaccinated; and the infant's attack was a mild one, and indeed regarded by the parents as "severe chicken-pox." The other child (No. 96) had a severe confluent attack. A young married woman No. 42. (No. 42) was found to be suffering from small-pox on the 29th and was admitted to hospital. She may have in- No. 60. fected another person who visited her (No. 60). The No. 45. seventh family in which more than one case arose, to be invaded in December, is that of H.'s, discovered in the course of a house-to-house inspection of the neighbourhood. The first to be attacked was N. H., æt. 12, unvaccinated (No. 45), whose illness was very mild, and was regarded as chicken-pox. It began on December 31, and her sister, No. 64. æt. 14, also unvaccinated (No. 64), sickened on January 6. They were both admitted on the 12th, the rest of the Nos. 82, 85, 87. family, seven in number, being taken into quarantine. Of these three sickened, viz., No. 82 on the 16th, No. 85 and No. 87 on 17th.

No. 46. The case of C. G. (No. 46), who was admitted with a very mild attack on January 3rd, is of interest in regard to his infection. He had been, on December 19, to see his mother at Halifax; she died from small-pox (and apoplexy) on the 21st; and he first showed symptoms of illness on the 31st, returning to Leicester on January 2nd, visiting in the meanwhile his sister's family at Keighley.

No. 47. F. L. (No. 47) had been engaged on railway works at Chesterfield, and on December 19th had stayed at a house where a man had small-pox. He was himself attacked on the 31st; taken to hospital on January 5th; his sister, Mrs. No. 84. M. (No. 84) falling ill on January 17th.

1893.

January.—Two very mild cases in a brother and sister Nos. 49 and 81. (Nos. 49 and 81) occurred at the beginning of January, the former attacked on the 1st, the latter on the 15th. She had been re-vaccinated on the 9th, the day after the removal of her brother to hospital, but it did not take. No clue was obtained to the source of infection in No. 49 nor in No. 50. that of No. 50, a young woman of 21, the eldest of a family of ten, of whom the two youngest, æt. five and six, were not vaccinated. No second case occurred in this No. 54. house. A school girl, æt. 8 (No. 54), was attacked on the 3rd and admitted on the 8th; she had a severe attack, characterised in its later stages by continual re-formation of the crusts, so that it was long before the skin was clear. At this time another family had several members attacked, a circumstance which in this, as in other instances, was associated with the non-recognition of the nature of the first case. This was a lad of ten years (No. 55), unvacci- No. 55. nated, whose illness commenced on the 3rd, the eruption, which was discrete, appearing on the 5th. The family consisted of eight members, three of whom were un-vaccinated; and four were infected by small-pox, viz., No. 90 No. 90. (vaccinated), attacked on the 18th, No. 91 (vaccinated) on the 18th, No. 93 (unvaccinated) on 19th, and No. 101 Nos. 91, 93, 101. (unvaccinated) on 22nd. It was when investigating these cases that the Medical Officer of Health found marks of previous small-pox on the limbs of No. 55, whose rash had been ascribed to chicken-pox. They were removed to hospital on the 23rd and 24th, one of the cases (No. 93) being a confluent attack. Two unvaccinated children of another family (origin also untraced) were admitted in this month; the first (No. 56) was attacked on the 4th, the Nos. 56, 89. second (No. 89) on the 18th. A case (No. 58) in a young No. 58. man, vaccinated, was received about a week after the rash appeared (January 6th); there were 8 members of his family, all unvaccinated, and no second case occurred in the house. But a fellow worker with No. 58 was attacked on January 17th (No. 86), and two others (Nos. 100 and 102) Nos. 86, 100 102. on the 22nd. The next case is of peculiar interest as presenting probably a rare instance of re-infection. Mrs. M. (No. 60) had been attending on Mrs. S. (No. 42) before No. 60. her removal to hospital on December 29th; and in consequence her family was kept under observation. No. 42 had sickened on December 24, and on January 5th, *i.e.* 12 days later, Mrs. M. had premonitory symptoms;* a few shotty-like papules appeared on the skin of the back on the 6th, but there was no pyrexia, when she was admitted on the 8th. The case being equivocal, she was put into one of the detached wards adjoining a general ward, and attended by a nurse, who subsequently sickened with small-pox (No. 106). Mrs. M. miscarried on the 12th. She left the hospital on the 23rd, and was re-admitted on the 30th (No. 111) suffering from a much more definite attack, which had commenced with rachialgia, headache, and vomiting on the 28th. She now had several large discrete pustules on the face, the maculæ of the previous eruption being visible on the back. If this were not a case of re-infection, and the primary illness not small-pox, it is singular that she should previous to that illness have been in contact with a case of small-pox, and that the nurse in attendance should have contracted the disease. The evidence in support of re-infection seems to outweigh the argument that these form merely coincidences. The nurse in question (No. 106) presented a rash on January 23rd, No. 106. and would therefore have been attending on No. 60 when infected. Her attack was a very mild one. She had been re-vaccinated ten years previously, but not on the present occasion. The large common lodging-house in Lee Street where two cases occurred in October and November (Nos. 10 and 19) again became infected. The first to sicken was Mrs. K. (No. 62), the wife of the manager; her illness No. 62. began on the 4th January, and she was removed on the 8th, the house being kept under observation. On the 12th, *i.e.*, at too brief an interval to be infected by No. 72, one of the inmates, a man 50 years of age (No. 78), was attacked; No. 78. his case was a very mild one, and he went about with the rash out, but was identified and removed on the 18th. Then follow a series of other lodgers, each infected in turn, viz., J. S., æt. 70, (No. 109), a man who bore the marks of re- No. 109. vaccination done 40 years before; when he first ailed about 28th January, he was sent to the workhouse infirmary, but spots appeared on February 1, and he went to hospital on the 3rd. Re-vaccination had been offered to the inmates of the lodging-house, 102 in number, but declined by all. Another inmate, F. R., æt. 20 (No. 112), sickened on the No. 112. 28th January; he was vaccinated (one large scar), but had a severe confluent attack. J.U., æt. 52 (No. 132), who No. 132. had been re-vaccinated 20 years before, had a very mild attack, which commenced on February 16; he was removed on the 25th, the case not being at first recognised. He apparently infected four other inmates:—No. 141, attacked Nos. 141, 142, 144, 145, 14 151. March 11, No. 142 March 5, No. 144 March 8, No. 145 March 8, No. 146 March 9 (who went to the workhouse on the 11th and was transferred thence to the hospital), and the final case of the series was that of B.F., æt. 62 (No. 151), who was attacked on March 22. No other cases occurred in this lodging-house after this.

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* I find in my notes that Mrs. M. visited Mrs. S. on the 22nd, and not again until the 27th. If she really were infected by the latter the infection must either have been received before Mrs. S. showed any signs of illness, or the incubation period of Mrs. M.'s case must have been unduly short.

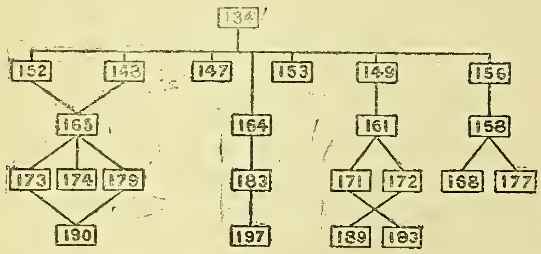
Reference may also be made to the cases sent to the hospital from the workhouse. Besides Nos. 1, 4, 22, and 35 which arose in August, September, and November, there were in January two cases, Nos. 68 and 99; in February two, Nos. 118 and 125, and in March 146 and 154. It will be convenient to deal with these now. They were not connected with one another, and were mostly men who had come to Leicester on tramp. No. 68 was in the Union for about four days with a few papules on him; the onset of his attack being on January 7th, and the rash had been out about nine days before he was sent to the hospital. No. 99 probably contracted the disease at Bromsgrove, whence he had tramped to Leicester; his attack was extremely mild, barely half a dozen papules. He had three scars of re-vaccination in addition to three on each arm of his primary vaccination. No. 118 had come from London to Leicester; he also had been re-vaccinated (two years before) and had a very mild attack. No. 125 had previously been in a lodging-house in B—— Street, where it is supposed he was infected. No. 146, as stated, was infected at L—— Street lodging-house, and went from there to the workhouse infirmary. No. 154 had been tramping from Cambridge to Newmarket at the time of his presumed infection.

M. V., æt. 20, a wardmaid at the hospital who had declined to be re-vaccinated, sickened on January 7 (No. 66). On the 8th her temperature was 104°, on the 9th the rash appeared, and the pyrexia abated. The eruption was composed of papules of various sizes, mostly discrete. She had four large foveate vaccination scars on the left arm.

G. L. (No. 70), æt. 23, may have been infected at a public-house, where he mingled with several people a fortnight before he himself took ill on January 8. He had a proper coherent rash, but the papules instead of really maturating on January 20, became more consolidated and pale. He had four vaccination scars. No. 71 was a child, æt. 5, who had been attending school with a rash out on him, which was found by Dr. Priestley to be small-pox. The papules were small and discrete; the child was unvaccinated. No. 72 was another child, 8 years of age, who attended the same school as No. 55, and as in that case, so here, the diagnosis was not made until another member of the family had sickened (viz., No. 104, a child of five, whose rash appeared on the 28th). It was then found that No. 72 presented evidence of having had small-pox, his rash appearing on the 11th (that of No. 55 had come out on the 3rd). Later, a third member of this household (No. 126), a young woman æt. 21, sickened on February 9, and had a mild attack. S. C., another unvaccinated child (No. 73), was attacked on the 9th, and admitted on the 12th. There were three other unvaccinated children in the family, but they did not contract the disease. In this case the pustules were remarkably large, prominent, and surrounded by wide areolæ. No. 74 was a friend of Mrs. S. (No. 42), and was in her company on the 26th December (No. 42 was then sickening); the rash in her case, a discrete one, appeared on the 12th January, her illness beginning on the 10th. No. 75 is the case of a young man which was not discovered till the mild attack from which he suffered had passed; it had commenced on the 9th, and he had remained at home. Another case treated at home is that of No. 79, a medical practitioner; but it was so slight, and recovery so rapid, that it has only been included in the list with some hesitation. No. 76, who sickened on the 9th, No. 80 on the 13th, and No. 83 on the 16th, were also mild cases, of which the origin could not be traced. No. 80 was living at a lodging-house with 48 other lodgers, none of whom were attacked. Next to be mentioned are three members of a family, of which the first to be attacked was a schoolboy (No. 88) (? attending same school as Nos. 55 and 72), who sickened on the 17th, and was admitted on the 19th. He was unvaccinated, and had a severe confluent attack. Two other unvaccinated children escaped; but No. 119, a lad of 16, vaccinated, had a very mild attack, commencing on February 2; and the father, æt. 35 (No. 124), also vaccinated, sickened on February 4, for a mild attack. On January 20 I accompanied Dr. Priestley to a house in B——Street, where an infant (No. 95) had just died after 24 hours' illness. It presented some subcutaneous petechiæ, and was regarded as a case of malignant small-pox. There seemed to be some connexion between this case and Nos. 42 and 74, with whom the family was acquainted; and the child's father bore equivocal traces of a recent eruption. He had not, however, been ill. A child, 7 years of age, neighbour to the A. family (two of whom had had small-pox, viz., No. 56, removed on the 7th, and No. 89 on the 20th), sickened on the 20th. This child (No. 97) was unvaccinated; her attack was a very mild one. Nos. 103 and 107, who were attacked on the 22nd and 28th respectively, were cases the origin of which could not be traced. No. 105, an unvaccinated girl of 12, who had a
severe confluent attack, accompanied by hæmorrhage,
attended the same school as No. 88. Her illness began on
the 37th, ten days after No. 88 sickened. The case of
No. 108, a girl of 14, was clinically interesting. She had No. 108.
developed a very scanty eruption on the 27th, and had a
very mild attack, *quoad* small-pox; but three weeks later
symptoms of meningitis supervened, and for some days her
condition was critical. Although it seemed probable that
she contracted the disease when going to or engaged at
her work (which she had only resumed after eight weeks'
absence for "rheumatism" on January 14th), no prior case
known to have been in contact with her was discovered.
An unvaccinated child (No. 110), æt. 4, who sickened on No. 110.
the 28th, may have been infected a fortnight previously by
a visitor coming from a house where small-pox then was.
The child had just then been attacked with scarlet fever.
It was admitted to hospital on the 3rd February, and died
on the 8th. Its mother (No. 130), had a very mild attack, No. 130.
which commenced on February 56, *i.e.*, the 14th day of the
child's removal. No. 113 was visiting near infected houses No. 113.
on the 15th, and was attacked on the 29th; Nos. 115 and Nos. 115, 117,
117, attacked on January 29 and 31, could not be traced; 116.
whilst No. 116, who also fell ill about the same time, may
possibly have been infected when engaged in some plumbing
work on the hospital premises. He was, however, only
engaged on the part most remote from the small-pox wards.

February.—The first case in this month's record is
another which was untraced, a man, æt. 30 (No. 120), whose No. 120.
illness commenced on the 3rd: he was admitted on the 8th
and had a very slight attack. B. G., æt. 7 (No 12), had No. 121.
been staying with some relatives a fortnight previous to
his attack, which began on the 4th. In the course of his
inquiries the medical officer found several children in this
house suffering from chicken-pox, and also evidences of a
case of small-pox which had passed unrecognised. No.
121 apparently infected his sister N. G., æt. 5 (No. 131), No. 131.
before his rash appeared, for she fell ill on the 16th. Both
these children had confluent attacks. They were unvaccinated,
as also was another child who escaped; but two
other members of the family were vaccinated (primarily) on
the appearance of small-pox in the house. No. 127, who No. 127.
sickened on the 11th, probably contracted the disease
outside Leicester, where she had only been visiting for a
week previous to her illness. A schoolboy (No. 129), æt. 7, No. 129.
was attacked on the 12th. How he contracted the disease
is not known; but he apparently infected his father (No.
136), who sickened on the 27th. There were four other No. 136.
unvaccinated children in this family. No. 133, a child of No. 133.
two years, sickened on the 18th; he had a coherent attack,
complicated by bronchitis. There was a history of mild
feverish illness in a relative living next door about three
weeks previously, but no tangible evidence that the child
had been infected there. His father, however (No. 143), No. 143.
was attacked on March 7th. A series of cases occurred
in three families about this time, which were not known
to the authorities until some weeks had elapsed. They commence
with the case of G. H. (No. 134), æt. 29, who was No. 134.
taken ill with headache and pains in the back on the 21st,
followed by a sparse eruption on the arms, wrists, ankles,
and forehead. His child, æt. 4, unvaccinated (No. 147), was No. 147
feverish and delirious on March 11th, and also had an
eruption like his father; the wife (No. 148) complained of No. 148.
pains in the head and back on March 13th; and her
infant (No. 152), whom she was then suckling, was taken No. 152.
ill a week later. Both children were unvaccinated, and in
both the variolous rash was sparse. J. W., æt. 30 (No. 153), No. 153.
a lodger with this family, was attacked about the same
time as the infant. These five persons comprised the
whole household; but from this source five other households
were invaded. C. P., æt. 16 (No. 149), was in the No. 149.
habit, together with her brother F. P. (156), of taking her No. 156.
dinner with the H. family. She had premonitory symptoms
about March 19th, followed by a very scanty eruption.
F. P. was taken ill a week later than his sister, and their
mother (No. 161) was in bed for two days with headache No. 161
and backache, about a week after F. P. was ill. She had
been re-vaccinated in 1872. Then Miss H. B. (No. 158) No. 158.
who "walked out" with No. 156, also had an eruption on
the face and arms about March 29th. This case was
notified and admitted to hospital about the 23rd day, but
two other members of the family were attacked, viz., No.
168, a girl of 8, who sickened on April 8, and had a No. 168.
coherent attack, and No. 177, a girl of 16, who sickened on No. 177.
April 12th, and had a discrete attack. Nor does this
conclude the series of cases ascribable to infection from
No. 134; for A. M., æt. 10 (No. 171), and F. M. (172), Nos. 171, 172.
unvaccinated children, who had fairly mild attacks, were
grandchildren of Mrs. P. (No. 161), and sickened on
April 10; they infected their mother (No. 189), who fell No. 189.
ill on April 23, and their unvaccinated sister (No. 193), No. 193.
æt. 3, attacked on the 26th. This last was the most severe

case of the whole series. Another family apparently infected from the same source is that of T. B., who was a fellow workman with No. 134, and acquainted with the P.'s No. 164. (No. 156, &c.). He (No. 164) had a mild attack, which was not notified and was thought to be influenza. His illness commenced on April 3rd, and of his three unvaccinated children, two had small-pox. The one, L. B., æt. 5 No. 183. (No. 183), was attacked on April 17th, probably infected No. 197. by him, the other B. B., æt. 5, (No. 197), attacked April 29, and probably infected by her sister. Again, the G. family were apparently infected through the father, being also a co-worker with No. 134. The first of his family to No. 165. be ill was Mrs. G. (No. 165), who had taken charge of the infant H. (No. 152) when its mother was ill. No. 165 sickened on April 4, and two of her unvaccinated children, Nos. 173, 174. (Nos. 173, 174) on the 10th; whilst the father (No. 179) No. 179. sickened on the 14th, and a third child (190) on the 24th. No. 190. Thus more or less directly connected with the unrecognised case of G. H. (No. 134) were six families, or a total of 37 persons, of whom 23 were attacked with small-pox (nearly all mild cases); whilst of 12 of them who were unvaccinated 10 were attacked. (*See* diagram.)



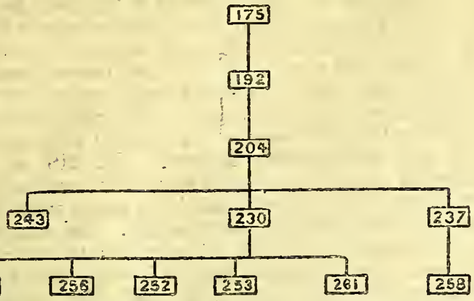
No. 135. Mrs. H. (No. 135), æt. 26, unvaccinated, had a severe semi-malignant attack. She lived in a house adjacent to one where several cases (Nos. 34, 77 &c.) had been occurring; she sickened on February 25th, and was removed on the No. 155. 27th. Her husband, æt. 28 (No. 155), also unvaccinated, was sent into quarantine with his three children. He was probably infected there, as he did not sicken until March 26th, *i.e.*, 12 days after leaving quarantine. His children, æt. three, six, and nine years, all unvaccinated, did not take the disease.

March.—Several cases were imported into Leicester during this month, but in no instance did they give rise to No. 137. others. No. 137 attacked on March 1st, in a lodging-house, probably contracted the disease in Northampton. He was in the Militia, and stated that he had been re-vaccinated six years previously, but the evidence of this was very equivocal. His attack, which was a confluent one, did not run a typical course, but absorbed at the stage of No. 138. maturation; the pustules rapidly desiccating. No. 138, attacked on March 1st, had arrived in Leicester on February 23 from Sheffield. She was an unvaccinated child, æt. 7, and had a mild attack, and contracted scarlet fever when Nos. 139, 140. in hospital. Nos. 139 and 140 were fellow labourers, who had arrived at Leicester from Derby on February 20. They No. 150. both sickened on March 6th. No. 150, a fortnight before his attack on March 21st, was in London or Oxford; and No. 157. had only been at Leicester for four days. No. 157, attacked on the 27th, lived in the Newfoundpool district, where so large a proportion of cases subsequently occurred. No. 159. The origin of the attack of No. 159 is obscure, for she had remained in her house during the preceding weeks, except on the one occasion a fortnight before when she went to the railway station to meet her husband. She was attacked No. 160. on March 28th. No. 160, who fell ill on the 29th, had been to the hospital on the 15th to meet her sister (No. 123), then leaving the building.

No. 162. *April.*—No. 162 was a "missed" case. He had felt ill on the 2nd, and a rash appeared on the 4th; but the case was not known until the following month when others were traced. It is possible that his child, who died from "convulsions" two or three weeks after his illness, may really have had small-pox. Probably connected with this No. 191. case is that of No. 191, an unvaccinated lad of 13, who on April 11th delivered coals at the house, and who sickened on the 25th. He had rather a severe attack, being removed to hospital on the 27th. One of his brothers, No. 209. æt. 10 (No. 209), sickened on May 10, and another, æt. 6 No. 218. (No. 218), on May 13. Both were unvaccinated, the former having a confluent, the latter a discrete attack. Another No. 202. case possibly traceable to No. 162 is that of No. 202 (May No. 163. 3) who lived close by. No. 163, attacked on 3rd April, attended the same school as some other children previously mentioned (viz., Nos. 88, 105, &c.); he was unvaccinated, as also were the five other children of the family, who, together with the mother, were taken into quarantine for two days, whilst their dwelling was being cleansed and disinfected. One of them, R. H., æt. 11 (No. 185), sickened No. 185. on the 19th and died from hæmorrhagic small-pox on the 25th. A family of whom four members were attacked is that of the M.'s. The first to fall ill was E. M., æt. 21 (No. 166), an unrecognised case, his illness commencing No. 166. on April 5th. Both the unvaccinated members of this family suffered; one, B. M., æt. 9 (No. 182), sickened on No. 182. April 16, and died from hæmorrhagic small-pox on the 24th. The other, E. M., æt. 6 (No. 187), sickened on the No. 187. 20th; his attack was a coherent one. Miss L., æt. 25 (No. 186), also living in the house, was attacked on the No. 186. 19th. It seems clear that the malignant case had a briefer incubation period than the others. Three other persons connected with these cases suffered. One (No. 201) was No. 201. employed at the same factory as No. 165, who had continued at her work with the eruption on her until April 20. No. 201 had a very mild attack commencing on May 2. No others in this factory seem to have been infected. Nos. No. 203. 203 and 210 were undertaker's assistants and had been No. 210. engaged in the burial of No. 182 on April 26. Both were unvaccinated, and the incubation period of No. 203 was unusually short (nine days) if he then contracted it, for he sickened on May 5th; but possibly, as Dr. Priestley suggested, his was a case of direct inoculation. No. 210 sickened on May 10th, *i.e.*, 14 days after this presumed exposure. I now come to a series of cases traceable to infection from a common source—a navvy (T. S.), who escaped observation and whose assumption of an alias made the task of clearing up the etiology of other cases somewhat No. 167. difficult for the authorities. No. 167 lodged with this man, and became ill on April 7th, Mr. and Mrs. H. (Nos. 169 Nos. 169, and 170), with whom they lodged, also falling ill on the 10th. A young woman (No. 178), who came in to assist No. 178. Mrs. H. in her household duties, sickened on the 13th. This patient had a coherent attack. [Although she presented a smooth scar on the arm it did not appear to be distinctly of vaccinal origin; and she stated that her mother had told her she had never been vaccinated.] G. B., æt. 33 (No. 180), the foreman of the works where "T. S." had No. 180. been employed, was attacked on April 14, and two of his three unvaccinated children who were infected by him died from small-pox. One, G. B., æt. 16 months (No. 194), No. 194. sickened on the 26th. He had double panophthalmitis and gangrene of feet, and died on the 17th May. The other (No. 198), L. B., æt. 3, sickened on the 30th, and died No. 198. after a prolonged attack with double panophthalmitis and deep ulceration of the face on June 27th. When "T. S." left the H.'s lodgings he seems to have gone (under an alias) to another house, where he lodged with the foreman of some other works from April 24 to May 15. This man (No. 217) was attacked with small-pox on May 13; he had No. 217. a severe confluent attack, complicated by delirium tremens and pneumonia. He had two vaccination marks. His son, æt. 15 (No. 219), was with other children vaccinated No. 219. (primarily) on May 16, and sickened with small-pox on the 17th. The attack was a mild one, and when I saw him he was covered with small, miliary, red papules, and the two vaccination vesicles were well marked. [We were told that this lad when two years old was "inoculated" by his mother from the arm of his recently vaccinated sister; but there was no cicatrix to show that this had been at all effectual.] A lodger in the same house, æt. 23 (No. 207), No. 207. was attacked on May 8, and had a coherent eruption, which dried up rapidly. He had three large foveated vaccination scars.

Mrs. M., æt. 23 (No. 175), was taken ill on April 10 No. 175. with what was thought to be influenza. Her parents, Mr. and Mrs. B., lived hard by, and her married sister, Mrs. W., in the town. Mrs. B., æt. 56 (No. 192), had a slight illness, No. 192. for which she kept her bed for a few days, from April 25; her husband (No. 204) also took ill with "influenza," No. 204. which he was thought to have contracted from his wife, his attack beginning on May 6, and he kept his bed for 10 days. The real nature of these cases was revealed by the illness of Mrs. W. (No. 230), who sickened on May 25, No. 230. developed a rash on the 27th, notified as small-pox on June 2nd, and removed to the hospital on June 1st. Her husband (No. 253) was attacked on June 9th, and their two No. 253. unvaccinated children: No. 252 on the 8th, No. 261 on No. 252. the 12th, the latter being a confluent case. A neighbour, No. 261. Miss B., æt. 17, also sickened (No. 256) on the 10th June. No. 256. [This case was a remarkable one in a vaccinated subject. The rash was most copious and confluent, but in four days it began to dry up, and there was no secondary fever; so that she was out of bed in a fortnight.] The brother of Miss B. sickened on June 13th (No. 265), and was pro- No. 265. bably infected by Mrs. W. In addition to these cases traceable to infection from Mr. B. (No. 204), there was the case of Mrs. G., æt. 52 (No. 243), a neighbour to the No 243. M.'s, who sickened on June 1st; whilst Mr. M. himself

(No. 237) was attacked on May 28th, and sent to hospital on June 1st, and his child (No. 258) on June 13.



Of the rest attacked during April, Nos. 176 (attack on the 11th) and 184 (on the 17th) were navvies at work together on a sewer, and small-pox occurred amongst others of those employed. No. 181 had been at an athletic meeting a fortnight before he sickened, April 16, and may have contracted the disease there. The source of the illness of No. 188 (April 23) could not be discovered. Miss E. B. (No. 195), a schoolmistress, unvaccinated, was attacked on April 27th. She had recently returned from a visit to Coventry, where she was nursing a friend who was said to have "chicken-pox." There can be little question that she here contracted the disease, which she had in a severe confluent form, followed by extensive pitting of the face.* Next come a series of cases which arose at T——, a village near Leicester, whence a case (a man engaged on sewer works) had been taken into the Leicester Hospital, about the 11th April. B. S., æt. two years, unvaccinated (No. 196), living in this village, contracted the disease from her father, and besides her his wife sickened later, as well as another child. B. S. was sent in to Leicester to stay with her grandmother, who kept a sweetstuff shop, where she was found by the medical officer in his inquiries into the origin of another case. No. 196 was attacked on the 28th, but not admitted to hospital until after maturation of the rash, viz., on May 9th. E. S., f., æt. 16 (No. 222), and J. S., m. 14 (No. 223), both unvaccinated, contracted it from their niece, sickening on May 19th (confluent attacks). No. 208, a boy of six, who frequented the shop, was also infected by No. 196; he sickened on May 10; and a like origin may be ascribed to the attack of No. 224 (May 20), who visited the house and saw B. S. with the rash full out. The origin of the illness of E. H., æt. 16, a bricklayer (No. 199), who sickened on April 30, is not ascertained. He lived in Newfoundpool. He was unvaccinated, and had a discrete attack. His father (No. 220) fell ill on May 17th, the last day of the "quarantine" supervision. A fellow worker (No. 251) with these at new buildings in the district was attacked on June 8th. He was 28 years old, unvaccinated, and had a coherent attack. [He stated that his mother was suffering from small-pox at the time of his birth.]

May.—Several "single" cases in households occurred during this month, and most of them not traceable to previous cases. No. 200, however, who was attacked on May 1st, was a wardmaid at the hospital who had declined to be re-vaccinated. Her attack was a very mild one. No. 205 sickened on the 8th; he may have been infected in London, where he had recently been. No. 206, attacked also on the 8th, was engaged at work in Newfoundpool. No. 211, unvaccinated, attacked on the 10th, possibly contracted small-pox in the course of cycling excursions. He had a confluent attack. No. 212, a boy of 7 years, was attacked on May 11, origin not traced. He did not go to hospital till the 17th, and a playmate of his, E. C. (No. 239), sickened on the 29th, and her brother on June 13th. K. G., æt. 9 (No. 213), the child of a lodging-house keeper, sickened on the 11th. There had been other cases amongst children attending the same school. She was unvaccinated, and her attack was a discrete one. Her infant brother (No. 238), who caught it from her, was attacked on the 29th, his case being a coherent one. A child from another house (No. 233) was with No. 213 when she was at home suffering from the rash, viz., May 13 to 16; and he (No. 233) sickened on the 27th. No medical man had been called in to K. G. until maturation of the pustules had occurred; and the same happened in the case of C. G., æt. 5, who sickened on the 11th, and was admitted on the 17th. This child (No. 214) lived at a tavern, but the source of her illness was not ascertained. Similarly there was no evidence of the origin of the case of No. 215, an unvaccinated youth, who had a confluent attack commencing on May 11th, and of No. 216, an unvaccinated child of five years, who was desquamating from scarlet fever when admitted, and who had quite a mild attack of small-pox beginning on the 11th. He was taken into hospital on the 16th, and his father (No. 240) **No. 240.** was attacked on the 30th. Six mild cases occurred in a family of seven, arising probably from the visit of one of the hospital staff to the house about some dressmaking. These cases (Nos. 221, 244, 245, 246, 247, and 248) will be referred to subsequently. No. 225, whose attack com- **No. 225.** menced on May 20, the rash appearing on the 22nd, was not admitted to hospital till the 26th. He was an unvaccinated child of 5 years, and his confluent attack was complicated with dysenteric symptoms. He lived at Newfoundpool. Another unvaccinated child, æt. 7 (No. 226), **No. 226.** who sickened on the 21st, had a discrete attack, not traceable to a preceding one. Mrs. M. (No. 227), living in the **No. 227.** centre of the town, had a mild attack which began on the 23rd. How she contracted it is not known, possibly in the course of her vocation as a Scripture reader. A next door neighbour, A. A., f., 27, sickened on June 7th (No. 249), **No. 249.** Mrs. M. not going to hospital till May 29. No. 228, an unvaccinated child of 10, who had a confluent attack, may have been infected at her village T., where other cases had recently occurred; she was, when attacked, staying with her sister in Leicester. Mrs. D. (No. 229) was an "un- **No. 229.** recognised" case, and never came into the hospital; she was ailing on May 24, and had some spots thought to be chicken-pox; but her husband (No. 255) was attacked **No. 255.** with small-pox on June 10. No. 231, a Newfoundpool case, **No. 231.** was also overlooked, and was not admitted until convalescence had set in. L. P., æt. 8, unvaccinated (No. 232), **No. 232.** lived next door to a house whence six weeks before some cases had been removed. She sickened on May 27, and was removed to hospital on the 31st, when the house was fumigated, the bed removed and disinfected, and returned to the house on June 2nd, when it was occupied by Mrs. P. (No. 272), who was taken ill on the night of June 16, **No. 272.** *i.e.*, 16 days after the child had left. No. 234, a confluent **No. 234.** case in an unvaccinated adult, and No. 238, a severe discrete **No. 235.** case in a vaccinated adult, were fellow labourers at W., a suburb of Leicester, where cases were known to be present. No. 236, an unvaccinated adult, the foreman of some sewage **No. 236.** works, and alcoholic in habits, sickened of confluent (malignant) small-pox on the 28th May, and died on June 8.

At my visit on June 29, Dr. Priestley took me to see **No. 241.** G.W.R., æt.23 (No. 241), a young man, vaccinated in infancy, who had recently passed through a brief illness attended by a rash, the maculæ of which on the face and limbs seemed to be unequivocal. He had not felt well on May 29, and spots had appeared on the 31st. Subsequent to this seven out of the remaining eight members of his family—all but two of them had been vaccinated in infancy—had illnesses which could only be small-pox, although in several the eruption was extremely sparse. One, L. R., f., 21 (No. 263), sickened on **No. 263.** June 13, two—H. R., 8, and E. R., 12 (Nos. 267, 268)—on **Nos. 267, 268.** the 14th, the relative sparseness of the rash being concordant with their ages. K. R., æt. 14 (No. 257), sickened on **No. 257.** the 11th, *i.e.*, on the 13th day of her brother's illness. Of the two unvaccinated children, A. R., f., 2 (No. 262), took **No. 262.** ill on the 13th, and had a coherent attack, followed by **No. 273.** abscesses, and M. R., f., 7, on the 19th, had a severe discrete attack; whilst G. R., æt. 51 (No. 270), whose illness **No. 270.** began on the 17th, had a mild discrete attack. No. 242, a **No. 242.** young woman of 19, sickened on May 31st; but it is not known where she contracted the disease.

June.—During this month out of a total of 25 newly-invaded households, 14 were in the Newfoundpool district, and, with hardly an exception, the very thorough and searching inquiries made by the medical officer and sanitary inspector failed to trace the origin of the first cases arising. This fact is the more striking in view of the remarkable manner that many a history had been unravelled and the disproportionate incidence of the disease on the community of the district led Dr. Priestley to surmise that the infection proceeded from the hospital, possibly by aërial diffusion or through mediate agencies. There are 18 cases in this group of which one, already mentioned, No. 251, may have been infected by a fellow-workman. The remainder fell ill on the following days: June 12th, one case; 15th, one; 17th, one (and two later cases in the house) sickening on the 23rd and 29th respectively; 18th, two; 19th, two; 21st, one; 23rd, four; and 30th, one case. In two instances besides that above noted, a later case arose in the house. One of these was remarkable in the fact that the second case (No. 345), the father **No. 345.** of the first patient was not attacked until November 20th, whereas his child (No. 243) had only been in hospital from **No. 243.** June 27 to July 13. Clearly this was a re-infection of the house or No. 345 had contracted the disease from a fresh outside source. In the other instance the first outside No. 299. case (No. 290), an unvaccinated infant, sickened on June 30, but the case was not known to the authorities until August 8, when, together with a second case, an unvaccinated child No. 299. of three (No. 299), who had sickened on July 14, it was removed to the hospital. These cases had infected two Nos. 315, 316. others living in another house, viz., Nos. 315 and 316, who were attacked on August 13th, both unvaccinated children, one a discrete the other a confluent case.* Of the cases arising in the town during the month, five were connected with previously occurring cases and have been already noted. There remain six, all in separate houses, and in none No. 250. of which was the origin clear. These are, No. 254, a young man of 20, unvaccinated, illness began on the 10th; No. No. 260. 60, an unvaccinated child of ten years, attacked on the 12th; No. 266. No. 266, an unvaccinated child of seven years, on the 13th; No. 277. No. 277, M., æt. 20, vaccinated, who had a mild discrete No. 86. attack beginning on the 19th; No. 286, a girl of 18, who may have been infected by visiting a dressmaker's in Newfoundpool, although no case was in the house), and who had a mild attack starting on the 26th, and No. No. 287. 287, a case open to much doubt as to its nature, in a woman of 47, whose rash appeared on the 28th, but took an anomalous and chronic course, and whose case was not notified until August 1st.

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* The case of this young woman has been referred to in evidence given before the Commission. (See evidence appended to the Commission's Fourth Report, Questions 13,133–44 and 14,674–90.)

July.—In this month of 16 newly-invaded houses, 11 were in the Newfoundpool area, and apparently not directly connected with any preceding cases, although, of course, it would be difficult to disprove such connection in a restricted community like this. In only one instance did more than one case occur in the house. No. 302, æt. 29, had a mild attack beginning on the 25th July, and not removed to hospital till August 2nd, six days after the rash appeared; No. 13. and No. 313, one of two unvaccinated children in the family of five persons, was attacked on August 13, with confluent small-pox. Probably connected with these cases No. 319. are those of Nos. 319 (sickened August 30), and 320 No. 320. (August 31) whilst No. 319 infected an unvaccinated child of nine (No. 328), who had a confluent attack commencing on September 18. The nine other cases occurring in this No. 292. month were in eight households; one, No. 292, attacked on the 2nd, was discovered at home a week later and No. 294. removed to the hospital. Another, No. 294, an unvaccinated subject, æt. 23, sickened on the 5th, and was No. 295. admitted on the 11th; he had a coherent attack. No. 295, a young woman æt. 29, sickened on the 6th, and may have been infected by having been in the vicinity of the hospital or by calling at invaded houses. Her attack was a very No. 296. mild one. No. 296 was an even milder case, not admitted No. 297. to hospital. It began on the 6th. No. 297, a woman (vaccinated) of 45, was attacked on the 8th. It was elicited that 14 days previously she had attended a patient who was certified to have died from "typhoid" after an illness of three days, characterised by a profuse eruption and by violent delirium. If this account be correct the case could not have been enteric fever, and hardly anything else but malignant small-pox. No. 297 had a confluent attack, which, however, "dessicated," and though accompanied by secondary fever, was only followed by slight pitting, but by most extensive staining of skin. [She had two very faint scars on the left arm; and Dr. Priestley, from his experience of other similar cases in vaccinated subjects, felt sure that she could not have been unvaceinated.] Another vaccinated subject who had a rather severe attack No. 305. was No. 305 (f., 31), who sickened on July 26. It was not ascertained when she contracted it. The eruption in her case, although very profuse, did not pustulate to any extent, and what pustules did form were remarkably small. Her No. 310. sister (No. 310), who had been re-vaccinated on the 31st, one insertion taking, sickened on August 9th, with a very mild attack. Allowing for the usual period of incubation she must have been infected on the very day the first Nos. 307, 308. symptoms occurred in No. 305. Nos. 307 and 308, attacked on the 28th and 31st respectively, were both mild cases, the former passing unrecognised at the time and not admitted to hospital.

August.—Only eight houses were newly invaded in this month, four being in Newfoundpool; but of these three were traceably infected from previous cases. The remaining four households yielded nine cases. E. H., f., æt. eight No. 311. months, unvaccinated (No. 311), and G. O. H., æt. 20, No. 312. vaccinated (No. 312), were both attacked on the 10th, the infant dying in the hospital on the 22nd. On inquiry Dr. Priestley found Mrs. H., about 14 days before their illness, had also been ailing, and that she had a few "spots" which had left stains, but no medical man was called in. It is possible that she infected her husband and infant, but her case has not been included in my list. No. 314 is No. 314. the case of a young woman which occurred about this time but of which I had no details; she remained at home, and had a very mild attack. No. 317, an unvaccinated child No. 317. of eight years, had a discrete attack, marked by unduly large pustules. She sickened on the 21st, and had been away from Leicester between the 5th and 12th, the period when she was probably infected. No. 318, a married No. 318. woman 22 years of age, was living with her parents and four sisters in an ill-kept house in a court, when she was attacked with small-pox on the 26th. She was removed to the hospital on the 2nd September, the day after the rash commenced to fade. Each of her sisters and a lodger contracted the disease (Nos. 324, 325, 326), sickening on the 11th September, and the other (No. 327) on the 12th. Two were unvaccinated, C. F., æt. 14 (No. 324), and C. F., No. 324. æt. 7 (No. 325); the former had a coherent rash, the No. 325. vesicles being as large as peas, and she also had symptoms of laryngitis; the latter had a most profuse confluent eruption. The remaining two, E. R., æt. 19 (No. 326), No. 326. and E. F., æt. 10 (No. 327), who both bore large foveated No. 327. vaccination scars, had extremely mild, a febrile attacks; that of E. F. of such a doubtful character (only three or four spots in all), that she was kept isolated from the small-pox patients. The origin of these cases could not be traced, but the infant daughter (No. 331) of No. 318, No. 331. who had been sent to another house, sickened on September 21st, and was probably infected through her mother, who was suckling it, when she took ill, by No. 327, who visited the child on September 5, and again on the 12th, the latter date being that on which E. F. herself first ailed. This infant, who was unvaccinated, had a mild attack.

September.—Only four fresh centres occurred in this month, yielding six cases, the sources of infection in each of the four instances being unknown. No. 321, a girl of No. 321. 9, unvaccinated, sickened on the 3rd; she had a confluent attack complicated by purulent conjunctivitis. No. 322, f., No. 322. æt. 12, one of a family of six unvaccinated children, was attacked on the 6th; her illness was a mild one. Her sister, æt. 10 (No. 329), who had shared her bed, was No. 329. attacked on the 20th—a very severe confluent case—and the mother, æt. 45, (No. 332), attacked on the 21st. It is noteworthy that another child as much exposed to contagion from No. 322 as was No. 329, did not contract the disease. No. 332. No. 323, f., æt. 17, had a mild attack commencing on the No. 323. 11th, her brother having been taken ill with typhoid fever about the same time. No. 330, æt. 28, also a mild case, No. 330. sickened on the 20th.

October.—Six households were invaded in this month, yielding 11 cases; in two instances the first arising case being unrecognised, and in one that case not having medical attendance. No. 333 (a man, æt. 42), lived in a No. 333. street previously free from cases, and the source of his infection could not be ascertained. His attack, a mild one, began on the 10th. No. 334, a youth of 17, whose illness No. 334. commenced on the 6th, did not leave off work, and when subsequently seen presented a few characteristic pits and stains on the skin. One of his unvaccinated sisters, æt. 10 (No. 340), sickened on the 28th; her attack being a No. 340. discrete one; and another, æt. 8 (No. 342), apparently infected by No. 340, fell ill on November 13th, and had a coherent attack. No. 335, Mrs. S., æt. 22, had a mild No. 335. attack commencing on the 9th, and was not medically attended; her unvaccinated infant, (No. 338), was attacked No. 338. on the 20th, and admitted into hospital on November. 3rd. His attack was a severe one. The other inmates of the house consisted of the father (who was re-vaccinated) and three male lodgers under 19 years of age, all vaccinated. The case of Mrs. B. (No. 336) passed unrecognised, her No. 336. illness commencing on the 10th, and a rash appearing on the 12th. Her child (unvaccinated), æt. two years (No. 341), No. 341. sickened on November 2nd, and had a confluent attack, for which he was removed to hospital on the 6th, his father (No. 343), æt. 30, falling ill on the 20th November No. 344. This man, who had two vaccination scars on the left arm, had a confluent attack. No. 337 (f., æt. 25), was an No. 337. assistant in a large drapery establishment. It is not known how she contracted the disease, which began on the 14th October; but all the other employées (19 in number) in the establishment were forthwith re-vaccinated. No second case arose among them. No. 339 is a fatal (semi-malignant) No. 339. case in an unvaccinated woman æt. 29. Her illness (the origin of which was not traced) commenced on October 27th, and terminated on November 10th.

November.—Of the six houses freshly invaded in this month, three were in Newfoundpool, and yielded seven cases, as follows:—No. 347, an unvaccinated child of six, No. 347.

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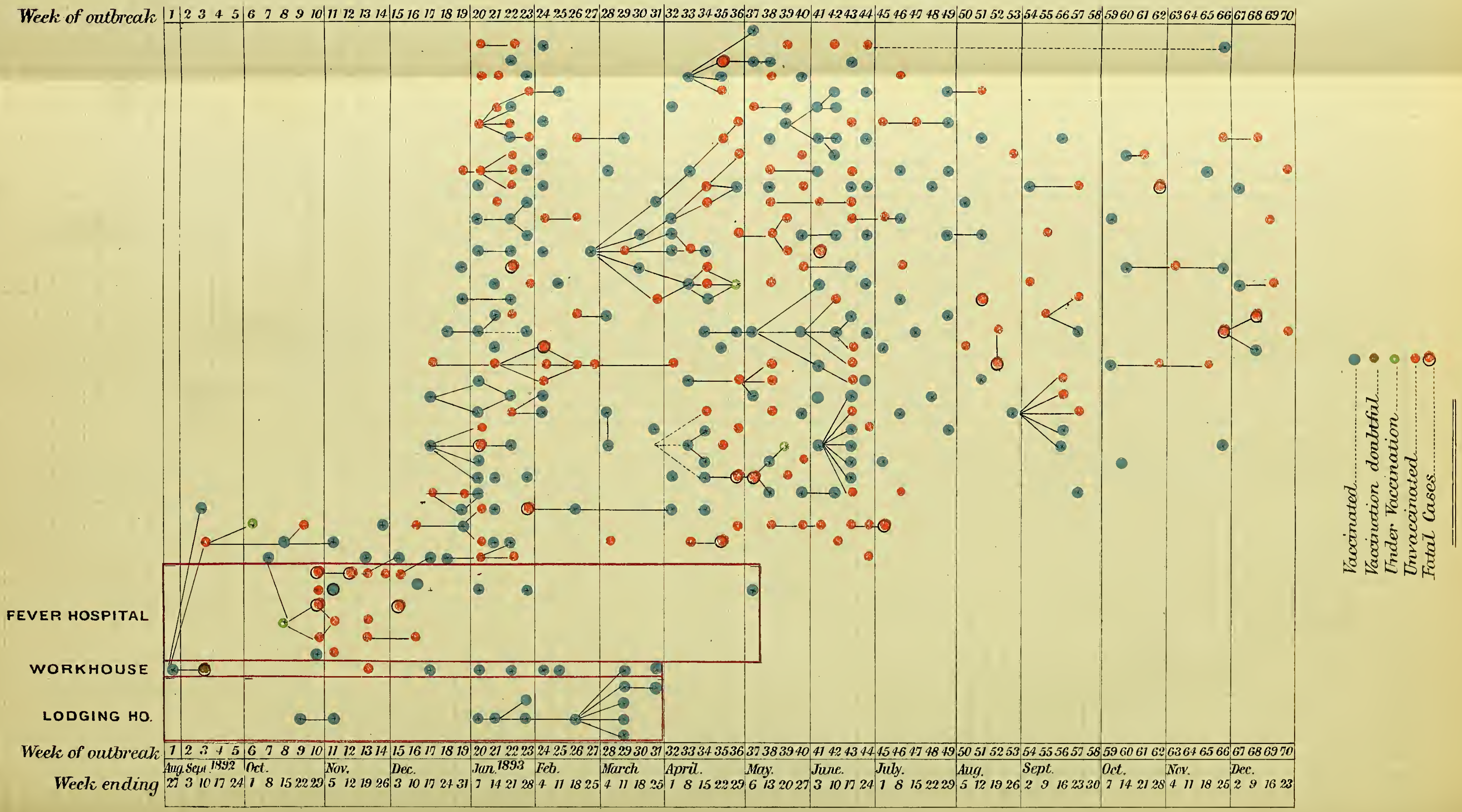
* Since writing the above I have seen a short account of the Newfoundpool outbreak published by Dr. Priestley, which sums up the whole argument in favour of the infection of the district from its vicinity to the hospital; and I propose to append this to the report.

Chart II.

LEICESTER SMALL POX, 1892-3.

Diagram to illustrate course of outbreak shewing the connection between cases of the Disease so far as this was traceable.



To face page 33.

was attacked on the 21st; and was removed to hospital on
o. 3. the 24th. Her mother (No. 355), æt. 27, also unvacci-
nated, sickened with severe symptoms on December 6th,
and was at once removed to an isolation ward at the
hospital, when on the 8th she developed a profuse rash,
which became afterwards confluent. Her infant, seven
o. 8. months of age, was not infected. No. 348, a girl of seven
(unvaccinated), sickened on the 22nd and died on the 26th
from malignant small-pox. She could not be removed
to the hospital, but her two sisters were attacked on
December 3rd, *i.e.*, 12 days after her illness began. Of
o. 1. these two, one (No. 351), æt. 19, vaccinated, had a mild
attack, only five or six spots on the arms and face; the
o. 2. other (No. 352), æt. two years, unvaccinated, died in the
hospital on December 7th, with hæmorrhagic small-pox.
o. 0. No. 350, f., æt. 42, vaccinated, had a coherent attack com-
mencing on November 30th, and it is singular that
precisely 14 days before she had been given a letter sent
from Bradford to her mother containing information of her
sister's death from small-pox, the letter having been sent
by the person from whose house the patient had been re-
moved on October 25. It would be difficult to prove that
a letter thus transmitted could be carried about for a fort-
night, and only infect a third person to whom it was shown
at the end of that period. Seeing the recent prevalence of
small-pox in the neighbourhood, it is hardly necessary to
seek an explanation for the attack of No. 350 in what was
most likely only a curious coincidence. The child of this
o. 4. patient (No. 354) sickened on December 12, and had a
confluent attack.

o. 3. The remaining cases arising in November are No. 343,
s 46, 349. m. æt. 18, attacked on the 16th; No. 346, f., 20, on the
21st; and No. 349, m., 19, on the 27th. This man was a
soldier on furlough from Chatham, where he had probably
been infected, for there was a small epidemic in that
town at the time not far from the barracks. It was ascer-
tained that his re-vaccination on entering the army "did
not take"; and certainly he only bore three primary scars.

December.—Only three houses were freshly invaded in
this month—one at Newfoundpool and the others in oppo-
s 55, 356, site quarters of the town. They yielded three cases (Nos.
57. 355 to 357), the origin of which was not determined.

For the map appended to this report, indicating the position of the houses infected during the outbreak, I am indebted to the Health Department.

The Fever Hospital Staff.

It will have been observed that six persons employed at the hospital contracted small-pox, viz., No. 13, T. G., æt. 43, employed in attending to the fires, &c. in the building, including the small-pox wards. No. 17, M. A. J., æt. 45, employed as laundress at the hospital. No. 37, E. P., æt. 25, who had been for a short time employed as a nurse in the hospital, having previously been in the laundry (quarantine cases). No. 66, M. V., æt. 20, a wardmaid. No. 106, E. W., æt. 40, a nurse in the small-pox wards 200, A. S., æt. 23, a wardmaid.

Of these, Nos. 13, 17, 66, and 200 had been vaccinated in infancy, but not re-vaccinated; No. 106 said that she had been re-vaccinated 10 years before; and No. 37 was re-vaccinated on the day that she showed premonitory symptoms.

No. 13 had a severe confluent attack his illness lasting seven weeks.

No. 17 was known to be of intemperate habits, and died on the 13th day of her illness.

The attacks in the cases of Nos. 37, 106, and 200 were extremely mild and characterised by very sparse symptoms, whilst No. 66 had a discrete attack

The staff at the fever hospital at the end of 1892 consisted of 28 persons, viz., one medical superintendent, 1 matron, 15 nurses, 1 cook, 3 wardmaids, 4 laundresses, 1 stoker, 1 porter and his wife. Of these 22 had either been re-vaccinated (including 8 re-vaccinated at the time of the outbreak) or had formerly had small-pox, and the only one who did not fall into these categories and who escaped attack was the matron, who visited the wards occasionally but took no part in the actual nursing of the cases. (*See* Dr. Priestley's Report.) "During the epidemic 1892–3, there have been "12 additions to the small-pox staff, consisting of 5 nurses "3 laundresses, 1 wardmaid, 1 stoker, 1 assistant porter, "and 1 quarantine assistant. They were all re-vaccinated." (*Loc. cit.* p. 120.)

ADDENDUM TO HISTORY OF OUTBREAK.

In view of the interest and importance of the question of the aërial dissemination of small-pox from hospitals, I have reproduced here from the columns of the "Lancet," (August 6, 1894), the text of a paper read at the Congress of the British Institute of Public Health by Dr. Priestley, which deals exhaustively with the Newfoundpool cases that were so disproportionately numerous to those in the rest of the borough.

The Aërial Diffusion of Small-pox.

Dr. Priestley said: "The subject for discussion to-day is an important one, and I am tempted to give you my own experience somewhat in detail: firstly, because I was at one time *against* the aërial theory of the spread of small-pox from hospitals; and, secondly, because the Leicester experience is practically unique. Whilst admitting all the arguments that may be brought against the aërial theory, I am bound to confess that some, at least, of the facts that I have met with during the Leicester epidemic are only explainable on such a theory. You may, however, judge for yourselves from the following facts. About the middle of June, 1893, the cases of small-pox notified as occurring in Newfoundpool district became numerous, and it has been impossible to explain many of them except by assuming that they became infected from the hospital. The exact manner in which this is brought about is, I confess, a somewhat difficult question to decide, though it would seem to be either (*a*) *directly* through contact between patients and people outside the hospital, and by infection carried out by visitors, members of the staff, &c.; or (*b*) *indirectly* through the air, which may be (1) the atmosphere or (2) sewer gas—*i.e.*, through the drains. Probably both means of infection play important parts. What is found in Leicester is that the comparatively greatest number of cases is to be met with at Newfoundpool, a community consisting of about 3,000 people living in 600 houses. The position of the houses in regard to the hospital is south or south-west, whilst the distance of the nearest houses from the hospital is 620 feet and that of the furthest 1,750 feet. In this way a circle of 2,000 feet radius, with the hospital as a centre, would take in all the houses. Newfoundpool being, as it were, an isolated suburb, we can easily treat of it separately, though by reference to a map of Leicester it will be seen that with a circle of double the above radius many cases of small-pox that have occurred in the north end would also be included.

"Taking the cases from the commencement of our epidemic and analysing them, we find that—

In December, 1892,	there	sickened	3	cases	Beatrice Road	2
					Pool Road	1
In January, 1893,	„	„	5	„	Beatrice Road	2
					Pool Road	3
In February, 1893,	„	„	0	„		
In March, 1893,	„	„	1	„	Ruby Street	1
In April, 1893,	„	„	1	„	Ruby Street	1
In May, 1893,	„	„	3	„	Ruby Street	1
					Hawthorne Street	1
					Beatrice Road	1
In June, 1893,	„	„	16	„	Rowan Street	2
					Beatrice Road	9
					Ruby Street	2
					Ivanhoe Street	3
In July, 1893,	„	„	10	„	Beatrice Road	3
					Ruby Street	2
					Ivanhoe Street	1
					Sylvan Street	2
					Newport Street	1
					Fosse Road	1
In August, 1893,	„	„	6	„	Oban Street	1
					Ruby Street	2
					Newport Street	2
					Beatrice Road	1
In September, 1893,	„	„	1	„	Newport Street	1
In October, 1893,	„	„	0	„		
In November, 1893,	„	„	4	„	Beatrice Road	3
					Ruby Street	1
In December, 1893,	„	„	5	„	Beatrice Road	2
					Ruby Street	3

"There have thus been 55 cases of small-pox in Newfoundpool, representing 38 infected houses, of which 16 were in Beatrice Road (23 cases), eight were in Ruby Street (13 cases), four were in Ivanhoe Street (four cases), two were in Newport Street (4 cases), two were in Rowan Street (two cases), two were in Sylvan Street (two cases), one was in Hawthorne Street (one case), one was in Oban Street (one case), one was in Pool Road (four cases), and one was in Fosse Road (one case).

"Further, of the 16 infected houses in Beatrice Road 11 were on the side nearest to the hospital (the back doors of the houses facing it), whilst Ruby Street, Ivanhoe Street, Newport Street, Rowan Street, Sylvan Street, Hawthorne Street, Oban Street, and Fosse Road all run at right angles to Beatrice Road—Rowan, Hawthorne, Ruby, and Ivanhoe Streets being nearest to the hospital at the respective distances, measuring to the middle of the streets, of 1,060, 1,077, 1,100, and 1,150 ft.

"Out of a total of 347 cases of small-pox 55 have occurred at Newfoundpool, giving a case-incidence there of 18·3 per 1,000 of the population as compared with 1·6 per 1,000 for the rest of the borough—that is to say, the Newfoundpool

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Explanation of Chart II:—

This Chart has been prepared to illustrate, so far as the dates permitted, the connexion between persons attacked by small-pox during the progress of the epidemic. The colours indicate the condition of the patients as to vaccination.

people have suffered 11 times as much as the rest of the town. It is only fair, however, to examine these 55 cases more minutely to find out, *e.g.*, how many have arisen from previous cases and how many there are for which we fail to discover any definite source save that of probable infection from the hospital. As the result of my examination I find that out of the 55 cases 20 may be attributed to previous ones—*i.e.*, may be regarded as quarantine cases. Deducting these 20 cases, we still have 35 cases (representing 34 infected houses) whose sources of contagion are difficult to explain, save on this theory of hospital infection. Treating now the rest of the cases in the town in the same way—*i.e.*, deducting all those that have arisen from previous cases (as traced out by me) and comparing them with the Newfoundpool ones—we find that the ratio is as 1 to 20.

"So, too, by working out the number of *houses* infected in Newfoundpool and the rest of the borough, we find the ratio as 1 to 15.

"Thus, however we examine the subject—whether from the point of view of all cases, corrected cases, or infected houses—we find that Newfoundpool district has suffered 11 to 20 times as severely as the rest of the town, and in my opinion this state of things has been brought about by the close proximity of the Small-pox Hospital. The death-rate of the Newfoundpool cases is 7·2 per cent., as compared with 5·8 per cent for the rest of the borough.

"Taking the June cases (16 in number), we find that they sickened between the dates June 8th and 30th, and, dating back from 12 to 14 days for the incubation period of small-pox, we may assume a period of acute infectivity in Newfoundpool district between May 25th and June 18th. If, now, we analyse the weekly hospital returns we find that during the same period (May 25th to June 18th) the average weekly number of small-pox cases in the wards was 46. Treating the July cases (ten in number) in the same way, we find a period of acute infectivity in Newfoundpool extending from June 20th to July 15th, during which period the weekly average of hospital small-pox cases was 34. Combining these two periods of acute infectivity, it would appear that the hospital practically caused its greatest infection in the month of June, during which the weekly average of small-pox cases in the hospital was 49—a larger average than in any month during the year, except February, when the weekly average was 54. Why small-pox did not spread into Newfoundpool during February is a question which naturally suggests itself, and to endeavour to answer which I will now proceed. As mentioned previously, there are various ways in which a small-pox hospital may act as a centre of infection. 1. It is acknowledged that infection may spread directly from person to person; so that it is readily understood how contact between patients, officials, visitors, &c. in the hospital and persons outside may spread the disease. Personally I have been unable, however, to trace such contact, and the stringent rules that have been enforced during our epidemic have, moreover, practically rendered such a means impossible. Even assuming such contact to have taken place, it is strange that it should have happened in June and not in February. 2. Air-borne infection does seem to play a part in small-pox epidemics if we may judge from various reports, not only those specially published by the Local Government Board but also those that have lately appeared in connexion with recent small-pox outbreaks in various large towns. The air-borne infection may be (*a*) above ground—*i.e.*, through the atmosphere—or (*b*) underground—*i.e.*, through the drains; and in either case it is reasonable to suppose that, taking a hospital as a centre, the cases would crop up more thickly the nearer the houses were to that hospital. Such is the case with the infected houses in Newfoundpool. In considering this air-borne infection there are many matters deserving our attention. Foremost are the accompanying meteorological conditions—*e.g.*, rainfall, temperature, direction of winds, &c.—and in considering these conditions I have been struck with the great difference as between February and June (see Table). In February the rainfall was 2·12 inches; the mean temperature low, varying from 45° to 31° F.; whilst the direction of the winds was principally west and south—*i.e.*, away from Newfoundpool and the state of the weather was blue sky on nine occasions and cloudy on 14, whereas in June the rainfall was 0·64 inches, the mean temperature high, varying from 70° to 45°, whilst the direction of the winds was principally north and east—*i.e.*, right over Newfoundpool from the hospital and the state of the weather was blue sky on 19 occasions and cloudy on nine. Meteorological conditions, therefore, would certainly favour the spread of germs from the hospital towards Newfoundpool during June, but not in February. The barometric pressure was low in February, high in June. 3. Another means by which germs might be carried is by flies, rats, &c., and, though at first blush this may seem a far-fetched theory, when examined more carefully it is not so. Some recent experiments made by Sawtschenko show that cholera bacilli can live in the alimentary tract of a fly and be found alone in the excreta. He fed flies on the intestinal contents of cholera cases and found the characteristic bacilli in their alimentary canals and their excretions afterwards. Considering the number of flies and rats we have had at the hospital (the flies we might speak of as a plague, in such quantities were they), it is easily understood how they might carry infection about, more especially during the warmth of June than during the cold of February.

"Everything, therefore, seems to favour the theory that our small-pox hospital has, during part at least of our epidemic, been a centre of infection; but the exact mode in which that infection has spread it is somewhat difficult definitely to decide, though personally I am satisfied that the air has played an important part. Germs might also pass through the drains and be drawn by the ascensional force of evaporation through sewer gas into the houses. It is, I believe, thought by some that Newfoundpool district is unsanitary, allowing of the escape of sewer gas into and around the houses there. I accordingly had all the houses infected by small-pox examined by the smoke test, with the result that of 38, only eight shewed any sanitary defects, and those but slight ones. Further, it is a remarkable fact that during our epidemic of typhoid fever (1893)[*] no case directly arose in Newfoundpool, and yet typhoid fever is acknowleged to be an index of the sanitary, or rather insanitary, state of a house or district.[†] I also had the whole of the houses on the north side of Beatrice Road—*i.e.*, all those houses whose backs face the small-pox hospital and are separated therefrom by 622 ft.—examined by the smoke test, with the result that out of a total of 54 houses, 41 gave no results and 13 showed slight defects—viz., escapes of sewer gas into external closets, through rain-water pipes connected direct with drains, or from round about defective gullies (sinks). Of these 13 houses four only had been infected by small-pox, whereas of the 41 that gave no results five were actually houses which had been infected by small-pox. Thus:—

54 houses	invaded by small-pox -	9	4 showing sanitary defects.
			5 showing no sanitary defects.[*]
	not invaded by small-pox	45	9 showing sanitary defects.
			36 showing no sanitary defects.[‡]

Rain-water pipes were only found directly connected with the sewer at Nos. ——, ——, and ——, Beatrice Road (the first only being a house infected by small-pox). There are no storm-water sewers in Newfoundpool, I am told. The only conclusion (if any) to be drawn from the above facts is that an insanitary state of the house drainage does not *per se* give rise to small-pox, even when near to a small-pox hospital. The Sanitary Committee, fully alive to the danger of a small-pox hospital being near to other buildings, have endeavoured during the year to find a suitable site away from the town, but as yet unsuccessfully."

§ 10.—Record of the Proceedings of the Town Council, Sanitary Committee, and Fever Hospital Sub-Committee, relating to the Small-pox Epidemic.

By the courtesy of the Town Council I am enabled to append here the text of the recommendations made by the Sanitary and Hospital Committees and of the resolutions bearing thereon which were passed at the meetings of the Council. They give in succinct form the history of the steps that were taken to deal with the epidemic.

It may be convenient if I here briefly summarise the chief points which arise out of these extracts, and thus to present in a connected form an outline of the history of the sanitary administration of the borough during this outbreak, so far as the information here furnished permits. It will be seen that quite early in the outbreak the Sanitary Committee received detailed reports of its progress from the Medical Officer of Health, giving particulars of the several cases and of the measures taken. Apparently the accommodation for quarantining families at the hospital soon proved to be insufficient, for we find that the Fever Hospital Committee on October 31st, 1892, passed a resolution to the effect that the "present arrangements for watching "persons at their own homes will be sufficient." But the "quarantine" block at the hospital was then occupied by children convalescing from scarlet fever, and on November 1st, it was resolved to invite parents, if they so desired, to remove their children therefrom. At the same time steps were taken to provide an iron building, the erection of which was sanctioned by the Sanitary Committee, who at the same time (November 2nd, 1892) arranged for the daily visiting by the inspectors "of the 40 convalescent " cases who had left the hospital to-day," and the Medical Officer was authorised to vaccinate any of these children if so desired by their parents.

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[*] One house in Oban Street became infected by typhoid fever from an outside source.

[†] It is only right to state that, previously to the decline in the number of Newfoundpool cases, several sewer ventilators in the streets there were by order closed and shafts run up some of the houses. This may have had a beneficial effect.

[‡] That is, so far as the smoke test showed.

On November 9th, 1892, the Town Council received a report from the Sanitary Committee recommending the erection of a new hospital for infectious diseases on the site of the existing one, at an estimate expenditure of 55,000*l*., the sanction of the Local Government Board being sought to raise a loan for that amount. The Town Council considered this report on November 15th, the amount of the loan being fixed at 20,000*l*. as a first instalment; but the proposal was rejected, there being an equality of votes for and against it, and the Mayor declaring it to be lost.

On December 14th, 1892, the Fever Hospital Committee resolved to institute an inquiry into the outbreak of small-pox at the hospital, and a special sub-committee for this purpose was appointed, with Ald. Clifton in the chair. This sub-committee met several times, and exhaustively investigated the earlier history of the outbreak, and in particular into the cases arising amongst the poor patients at the hospital. The inquiry extended from December 21st to March 2nd, 1893, when the sub-committee issued a report together with verbatim minutes of the evidence. That report was received by the Sanitary Committee on March 24th.

On December 16th, 1892, the Sanitary Committee decided to have plans prepared for three small buildings in lieu of the existing small-pox wards; and on December 21st, the Fever Hospital Committee recommended that the scarlet fever wards be utilised for small-pox.

On January 13th, 1893, the Sanitary Committee considered a report from the Medical Officer pointing out the importance of isolation of those who had been exposed to infection from small-pox cases, and suggesting an increase in the hospital accommodation, an improvement in the quarantine building, and urging the thorough disinfection of houses invaded by the disease. The committee decided to carry out the suggestion of improving the quarantine accommodation, and appointed a sub-committee to consider the question of erecting new temporary quarantine buildings. This matter was dealt with at the meeting of the Town Council on the same day, when it was agreed to provide additional accommodation for quarantine on the eastern side of the existing hospital at an estimated cost of 1,800*l*. Steps were taken on the 14th and 20th by the Fever Hospital Committee to carry out this resolution, pending the completion of which the chairman was authorised to arrange for the use of one of the houses belonging to the Corporation at Newaster, for temporary quarantine purposes, if found desirable. On February 28th, the Town Council received a report from the Sanitary Committee upon the tenders for the auxiliary building to be erected on the eastern side of the existing Infectious Diseases Hospital, and resolved to apply to the Local Government Board for sanction of a loan in connexion with these new buildings. A motion to defray the cost out of revenue, should the Local Government refuse its sanction, was put and lost.

Meanwhile the system of removing persons exposed to infection to 14 days' quarantine at the hospital was only being partially carried out. In many instances the alternative plan of daily supervision of such persons at their own homes was instituted; so that the need for extending quarantine accommodation was being less urgently pressed. It was indeed finally settled, on the adoption, on April 7th, by the Sanitary Committee of the joint report of the Fever Hospital and Zymotic Diseases Sub-committees, which was appointed on December 15th, 1892, to inquire into the outbreak of small-pox. The recommendations bearing on this matter given in this report was that "on a case of small-pox occurring, the " patient should be at once removed to the hospital, and " the other occupants of the house taken to a building " apart from the small-pox hospital, and given a disinfecting bath and their clothes disinfected. In the " meantime, the dwelling-house, and all therein should " be throughly disinfected, and afterwards they should be " allowed to return to their houses, but visited daily for 14 " days by a Sanitary Inspector, who should report to the " Medical Officer immediately any sickness occurred. . . ." " We are also of opinion that all persons who are frequently " brought into contact with small-pox patients should " adopt all protective measures known to science." It was further resolved, on April 14th, to print and circulate the report which had been drawn up by a minority of that special sub-committee, which did not, however, make any recommendations, but urged that the limitation of the outbreak had "confirmed the value of what is known as the " Leicester method of dealing with variolous outbreaks."

From a report made by the Medical Officer to the Fever Hospital, on May 10th, the steps then taken and referred to as consisting in (1) removal of patient to hospital and disinfection of rooms; (2) placing of inmates of infected house "under quarantine observation at their own homes" for 16 days; (3) notification of any illness among the "quarantined;" (4) the quarantined ought not to go to work during whole or part of their quarantine—compensation being allowed in each case, no more than to cover rent and maintenance, or if quarantined at hospital, only such as covered rent, and replacement of fresh clothes, bedding, or to replace those destroyed; (5) "Persons " whilst under quarantine observation are allowed to go " about and are encouraged to take walks into the country, " but are advised not to enter anybody's house, any public " institutition, or meeting, under penalty of forfeiting their " monetary allowance." The Medical Officer also stated that he was led to prefer to watch the people at their own homes to sending them into quarantine even from the opinions held by some that quarantine wards within the same curtilage as small-pox wards may be a source of danger to their inmates. (For his other statements see letter.) On May 12th the Sanitary Committee resolved that "the course of procedure in reference to quarantine in connexion with small-pox now being pursued as reported by " the Medical Officer to the sub-committee be continued " for the present."

I may here remark that this procedure virtually abandoned the method of removal of infected persons to quarantine, and substituted for it a system of supervision termed "quarantine at their own homes" in all cases, in which however a considerable amount of liberty was given to the people in their movements, and in certain cases permission granted them to continue at their employment. It is clear that this plan, which, it may be added, seems to have succeeded as well as the other, cannot be considered as equivalent to strict quarantine.

On May 30th and June 5th the Town Council had before them the report of the sub-committee on the outbreak, and the resolution of the Sanitary Committee thereon. An amendment to adopt the minority report was lost, and another amendment to the effect "that the Council " recognises the difficulties experienced by the Sanitary " Committee in dealing with the recent small-pox outbreak " in the borough and approves the arrangements now in " force for checking the further spread of the disease" was carried and adopted as a substantive motion.

On June 14th the Fever Hospital Committee had under consideration the reply of the Local Government Board declining to sanction a loan for the proposed new small-pox buildings in the vicinity of the present hospital, and resolved to again approach the Board on the subject.

On June 23rd the Sanitary Committee depute their chairman to make a statement to the Council "showing the " difficulties in which the Committee are placed in dealing " with the outbreak of small-pox."

On June 30th the Sanitary Committee decided to advertise for land for a site for a proposed now Infectious Diseases Hospital, and on July 31st the Fever Hospital Committee received offers of sites and inspected some of them. At the same meeting it is decided to re-open the fever wards;* but on September 26th the Sanitary Committee reported to the Council that "in consequence of the " continuance of small-pox your Committee regret that " they have been prevented for several months past from " authorising the reception of fever cases at the hospital." and mentioned their endeavours to procure another site for a temporary small-pox hospital. Such a site seems ultimately to have been selected by conference with the Sewage Farm Committee, but it was not utilised. At any rate a building was erected on the site of the present hospital, which reeived small-pox cases in January 1894.

I.

PROCEEDINGS and RESOLUTIONS of the TOWN COUNCIL.

November 9th, 1892.

REPORT presented to the Council by the SANITARY COMMITTEE on Wednesday, the 9th day of November 1892.

Proposed new hospital.

Your Committee have to report that they have further considered as to the steps to be taken for the erection of a new hospital for the treatment of contagious and infectious diseases, and they recommend that the plans prepared by Mr. Edward Burgess, for which the first premium was awarded, be adopted, subject to any modifications which it may hereafter be found desirable or necessary to make. The new hospital, which it is proposed to erect on the site of the existing hospital at Freake's Ground, will comprise the following buildings, namely:—

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* These wards were prepared for the reception of cases, but had not been re-opened at the close of the year.

Five blocks of scarlet fever wards, each block to accommodate 26 patients.
One block of typhoid wards, to accommodate 26 patients.
One block of small-pox wards, to accommodate 26 patients.
One block of quarantine wards.
Administration block.
Lodge, laundry, stables, mortuary, and other out offices.

Mr. Burgess states that "the architectural "character of the buildings has been kept as simple "as possible, and all superfluous ornament has "been avoided. The work is, however, estimated "as being very substantial and thoroughly well "built." The buildings generally will be faced with red pressed bricks, with as little stone as possible, and the roofs covered with Welsh slates.

The total estimated cost of the buildings is 45,834*l.*, but this is exclusive of furnishing, fitting, and other probable outlay. Your Committee are of opinion that the total capital expenditure in carrying out the scheme will amount to not less than 55,000*l.*, and they recommend that an application be made to the Local Government Board for their sanction to borrow that sum.

Your Committee, however, do not propose that all the buildings should be erected at once, but advise the Council to proceed with the scheme in sections, as it may be thought desirable, during a series of years. By adopting this course it will be unnecessary to remove more than a small portion of the existing hospital buildings at one time in order to make room for the new blocks, and thus a considerable amount of accommodation for the treatment of patients will be available during the progress of the new buildings. Your Committee recommend that the services of Mr. Edward Burgess be retained as architect to carry out the first block of buildings, leaving the question of the architectural superintendence of other blocks for the consideration of the Committee, and determination of the Council from time to time as it is decided to proceed with the work.

Your Committee recommend that authority be given to affix the common seal to a memorial to the Local Government Board to sanction the borrowing of the sum of 55,000*l.*

THOMAS WINDLEY,
Chairman.

Resolved:

That the Report of the Sanitary Committee be considered at a special meeting of the Council on Tuesday next at 5 o'clock.

Resolved:

That the Sanitary Committee be authorised to incur such expense as they may think necessary in any temporary accommodation at the Fever Hospital for the purpose of isolation and treatment of cases of small-pox.

15*th November* 1892.

The Town Clerk presents the report of the Sanitary Committee which was submitted to and received by the Council at the last meeting.

Moved, &c.:

That the report be approved and adopted.

By consent of the Council the original motion is amended as follows:—

"That the scheme for a new hospital as submitted by the Sanitary Committee be approved and placed before the Local Government Board with an application for a loan of 20,000*l.* as a first instalment."

For the motion of Alderman Windley as amended - - 24 votes
Against - - - - 24 „

The Mayor declares the motion not carried.

13*th January* 1893.

The following report was presented from the Sanitary Committee:—

Infectious Diseases Hospital.

"Your Committee have further to report that the number of cases of small-pox in the borough has increased considerably. All the known cases, numbering on Friday last 60, are in the Borough Infectious Diseases Hospital, and a large number of persons who have been in contact with these cases are isolated in the quarantine wards of the hospital, or at their own homes under observation of officers of the department. Your Committee are sensible of the great responsibility resting upon them, and they have every hope that, by energy and vigilance on the part of their officers, and with the co-operation of the Council and the public, the disease may be prevented from spreading to any considerable extent. If, however, the disease should assume more serious epidemic form, it will be necessary to be prepared with more hospital accommodation for the treatment of patients as well as for the isolation of persons who have been in contact with infection; in fact, the resources at the hospital for this latter purpose are now utilised to the utmost. Your Committee have therefore had under their consideration the question of providing more adequate accommodation, and they recommend that a building should be at once erected on the piece of ground on the eastern side of the existing hospital buildings, which may be available at an early date for temporary quarantine purposes. The building proposed is based on a plan published by the Local Government Board, and the estimated cost is about 1,800*l.* Your Committee request authority for this building to be erected with the utmost despatch. Your Committee have called to their assistance Mr. W. M. Cowdell, architect, to prepare the necessary plans and superintend the erection of the building.

THOMAS WINDLEY,
Chairman."

Resolved:

That so much of the report as relates to the provision of additional accommodation at the Infectious Diseases Hospital at an estimated cost of 1,800*l.* be approved and adopted.

28*th February* 1893.

Report by the Sanitary Committee.

"Infectious Diseases Hospital.

"The Sanitary Committee beg to report that they have obtained tenders for the erection of the auxiliary building which the Council, at their meeting on the 31st January, authorised to be erected on the piece of ground at the eastern side of the existing Infectious Diseases Hospital, and they have accepted the tender of Mr. J. E. Johnson, of Leicester, at 1,762*l.*, and request authority for the common seal to be affixed to the contract of Mr. Johnson and his sureties."

Moved, &c.:

That so much of the report as relates to the acceptance of the tender of Mr. J. E. Johnson for the erection of buildings in connection with the Infectious Diseases Hospital at the sum of 1,762*l.* be approved and that the common seal of the borough be affixed to the contract with Mr. Johnson and his sureties.

Amendment:

That an application be made to the Local Government Board for a loan of 2,500*l.* for the erection of the proposed new buildings at the Freakes Ground; and that a memorial to the Local Government Board be sealed with the common seal of the borough.

For amendment - - 24 votes
Against - - · 17 „

The Mayor declares the amendment carried, and it is then put as a substantive motion and carried.

Moved, &c.:

That the building at the Freakes Ground be proceeded with, and that, failing a loan being obtained, the cost be defrayed out of revenue.

For motion - - - 13 votes.
Against - - - 26 „

The Mayor declares the motion lost.

30th May 1893.

The Town Clerk submits the reports of the Medical Officer of Health on the small-pox outbreak, the minutes of proceedings of the Fever Hospital Sub-committee of the Sanitary Committee on their investigation of the outbreak of small-pox and report adopted by the Committee on the result of the investigation, copies of which have been furnished to each member of the Council.

Resolved:

That the reports be received and taken as read.

Moved, &c.:

That the report of the Sanitary Committee be approved.

Amendment:

That in the opinion of this Council the proposed report, which was voted for by a minority of the Sanitary Committee, and by direction of that Committee, printed and a copy sent to each member of the Council, contains deductions and conclusions reasonably to be drawn from the reported proceedings of the small-pox investigation, and that it be approved by this Council.

At about 9.30 it is—

Resolved:

That the discussion be now adjourned.

Resolved:

That the adjourned meeting be held on Monday next at 5 o'clock.

5th June 1893.

The Council further consider the motion for the approval of the Sanitary Committee's Report which was at the last meeting of the Council moved by Ald. Clifton and seconded by Ald. Eise, and the amendment thereto, which was moved by Mr. Biggs and seconded by Mr. Orton.

For Mr. Biggs' amendment	19 votes.
Against	25 ,,

Two members do not vote—15 members are absent when the vote is taken, and there are three vacancies.

By request the votes are recorded by the Town Clerk.

The Mayor declares the amendment lost.

Amendment:

That the Council recognises the difficulties experienced by the Sanitary Committee in dealing with the recent outbreak of small-pox in the borough, and approves the arrangements now in force for checking the further spread of the disease.

For amendment	36 votes.
Against	1 vote.

The Mayor declares the amendment carried, and it is then put as a substantive motion and carried.

26th September 1893.

Resolved:

That the Council at its rising do adjourn until Wednesday, the 4th October, at 5 o'clock, for the further consideration of the report of the Sanitary Committee so far as it has not already been disposed of by the Council.

From the report of the Sanitary Committee:—

" Site for Small-pox Wards.

"Your Committee have also to report that for some time they have been endeavouring to procure a piece of land to be used as a site for temporary buildings for the reception of cases of small-pox, with a view to the buildings at Freake's Ground being again rendered available for the treatment of scarlet fever cases. In consequence of the continuance of small-pox, your Committee regret that they have been prevented for several months past from authorising the reception of fever cases at the hospital. Your Committee are glad to be able to report that they have now, subject to the approval of the Council, arranged to purchase a piece of land, containing about 4¼ acres, situate in the Aylestone Lane in the parish of Wigston, and which the Committee are of opinion is very suitable for the purpose above mentioned. The vendor of the land is Mr. John Tebbs, of Glenfield, and the price agreed to be paid is 150*l.* an acre. Your Committee recommend the arrangement for the approval of the Council, and request authority to complete the same without delay."

4th October 1893.

Resolved:

That the Sanitary Committee be requested to confer with the Sewage Farm Committee and to report to this Council as to the practicability of providing suitable temporary small-pox hospital accommodation on some portion of the Beaumont Leys Estate.

2nd January 1894.

Resolved:

That so much of the report as relates to orders to carry out works and abate nuisances; to the public analyst; the inspector of food; persons treated at the fever hospital; erection of temporary buildings and certificates of contagious and infectious diseases be approved and adopted.

RESOLUTIONS OF SANITARY COMMITTEE.

30th September 1892.

Resolved:

That the Medical Officer forward a copy of his report on the outbreak of small-pox now read to the Local Government Board.

21st October 1892.

The Medical Officer of Health submits a report on the discovery of further cases of small-pox.

Resolved:

That all special reports of the Medical Officer of Health to this Committee on small-pox be printed and sent to members of the Committee for their private use and simultaneously to the Local Government Board.

2nd November 1892.

Resolved:

That the borough surveyor be directed to proceed at once with the foundations for the Humphrey's Building; also that a covered way be provided from the new building to the ward, and that the requisite fencing be fixed.

Resolved:

That the chief inspector and one assistant be deputed to visit daily the 40 convalescent cases which the Medical Officer reports to have left the hospital to day and report to the Medical Officer of Health each day.

Resolved:

That the Medical Officer be provided temporarily during the small-pox outbreak with a horse and carriage.

Resolved:

That the Medical Officer of Health be authorised to vaccinate any of the convalescent patients discharged from the hospital to-day if desired by their parents to do so.

4th November 1892.

Resolved:

That the Medical Officer of Health be authorised to furnish the information respecting the cases of small-pox in accordance with the request contained in the letter from the Secretary of the Royal Commission on Vaccination which is now submitted.

11th November 1892.

The town clerk reports the receipt of a communication from the Secretary of the Vaccination Commission stating that the Commission have appointed Dr. Sidney Coupland to attend at Leicester to make an investigation in reference to the outbreak of small-pox and requesting that the Corporation and their officers will give all facilities for the inquiry.

Dr. Coupland attends before the Committee and states the nature of his commission.

It is understood that the chairman will to-morrow meet Dr. Coupland in order to render him assistance in connection with the inquiry.

25th November 1892.

Resolved:

That under the exceptional circumstances of the case 30*s.* be allowed to Mr. Hackett who with his family has been in quarantine at the Fever Hospital and has sustained some loss thereby.

Resolved:

That 10*s*. a week be paid to Mrs. Brett for extra duties at the hospital during the small-pox epidemic.

16*th December* 1892.

Resolved:

That under the exceptional circumstances of the case 30*s*. each be allowed to Mr. Jones and Mr. Rowen, who with their families have been in quarantine, and have sustained loss thereby.

Resolved:

That under the exceptional circumstances of the case 30*s*. each be allowed to Mr. Dewick, who with his family has been in quarantine, and has sustained loss thereby.

Resolved:

That Mrs. Folwell's application to be allowed to visit her child at the Fever Hospital, who is reported to be dying of small-pox, be granted.

Resolved:

That the borough surveyor be instructed to prepare a plan for three small buildings in substitution for the present small-pox wards and that a sub-committee consisting of the chairman, vice-chairman Mr. Biggs, and Mr. Meadows be appointed to consult with the borough surveyor on the subject.

23*rd December* 1892.

Resolved:

That in consequence of the exceptional circumstances of the case 30*s*. be allowed to Mr. Lee, who with his family have been in quarantine, and has sustained some loss.

Resolved:

That 50*s*. be paid towards the cost of the funeral of the child Folwell, who has died at the Fever Hospital from small-pox.

Resolved:

That clothing be provided for the man George Moore, who has been in the hospital.

6*th January* 1893.

Resolved:

That the borough surveyor be instructed to obtain an estimate for a Manchester stove to be placed in the small-pox ward at the Fever Hospital.

Moved, &c.:

That under the special circumstances of the case, 12*s*. be paid towards the rent of Mr. Smith, who has been with his family in quarantine at the hospital.

Amendment:

That it be left in the hands of the accounts sub-committee to determine under the special circumstances of the cases of persons in quarantine, or under isolation, if any, and what allowances shall be made to such persons.

The Amendment is carried.

13*th January* 1893.

The Medical Officer of Health reads his report submitted to the Fever Hospital Sub-committee on Wednesday last as follows:—

Town Hall, Leicester,
13th January 1893.

GENTLEMEN,

WITHOUT wishing to alarm you as a sanitary committee, I feel it my duty to bring one or two matters which are of vital importance before your notice, and to ask your immediate consideration thereon.

You have now in Leicester, many different centres in which small-pox has broken out, and from which the disease may spread, so that it behoves you without further delay to make such preparations as may be necessary. I venture to remind you that Leicester is practically an unvaccinated town, and accordingly your sheet anchor in preventing the spread of small-pox is isolation, isolation not only of the cases, but of the persons who have directly or indirectly come in contact with them. Such isolation to be effective must be prompt, and with the many centres of infection already in the town I need not say that your isolation accommodation will be sooner or later (I may say is now in some respects) taxed to its utmost. Unless you are prepared to immediately isolate all your first cases as they crop up, you will soon lose your control over the outbreak or epidemic (call it what you will), which is at present threatening your hospital accommodation, your quarantine accommodation must be elastic and capable of stretching considerably if it is to be of any use. Further, no cases of small-pox ought to be left in the town if possible.

As your officer of health I beg to offer the following suggestions:—

(1.) That a temporary provision be immediately made for an extension of your hospital accommodation by means of tents or otherwise. The necessity for so doing must be apparent when you consider that your present hospital has only room for 140 cases, and when you remember how important it is to avoid anything of the nature of overcrowding in the wards of a small-pox hospital. Again there are already to-day in the wards of your fever hospital, 25 small-pox patients of whom 22 have been admitted during the last 12 days from 18 different centres. Admitting patients at this rate and remembering that the average stay in hospitals for small-pox is four to eight weeks, it is easy to calculate how long it will be before your present hospital will be full.

(2.) That some of the present quarantine wards be subdivided off by means of wooden partitions into a series of compartments, which would serve as separate bedrooms whilst the first large room could be kept as a dining and recreation room, and might with advantage be supplied with a variety of things that would tend to make quarantine life bearable if not enjoyable. I refer to bagatelle, &c. I recommend also that an extra w.c. or two be provided, and that a caretaker be appointed to look after the quarantine and the quarantine only. Further, as more quarantine accommodation will be (I may say is) needed, it may be well for you to consider the advisability of at once taking some house or houses in the town, away from the fever hospital houses wherein to place and watch people who have come into contact with small-pox cases.

(3.) That disinfection be carried out more stringently. By this I mean that all houses in which small-pox breaks out should be first thoroughly fumigated as customary with sulphur; but, further, that the wall papers shall be stripped off, ceilings and walls to be white or lime washed; all paints and floors be washed thoroughly with soap and water or with some disinfectant solution in addition to the stoving of all clothes and bedding in the hospital disinfecting machine.

In conclusion, I would remark that I have purposely avoided all reference to the all important subject of vaccination and re-vaccination—not because I do not value them as a means of stamping out small-pox, but simply because I feel the importance under the present circumstances of strengthening as much as possible your Leicester system and because I am most anxious to avoid anything of the nature of a discussion, which, unfortunately, in Leicester might at present prove useless. I shall, however, have something to say on the subject of vaccination and re-vaccination afterwards.

Yours faithfully,
J. PRIESTLEY.

Moved by Mr. Richardson, seconded by Mr. Ellis and carried:

That the report be received.

Moved by Mr. Richardson, seconded by Mr. Leavesley, and carried:

That so much of the report as recommends the partitioning of the quarantine ward be adopted and the work carried out.

Moved by Ald. Clifton, seconded by Mr. Ellis, and carried:

That the question of erecting new temporary quarantine buildings on the land adjoining the Fever Hospital site or other land be considered by a sub-committee composed of the following gentlemen, namely:—Mr. Biggs, Mr. Booth, Mr. Brady, Ald. Clifton, Mr. Ellis, Ald. Wilford, and Ald. Windley, and reported upon at the next meeting of the Sanitary Committee.

Moved by Ald. Clifton, seconded by Mr. Ellis, and carried:

That the Medical Officer's recommendation as to disinfecting the infected houses in the town be carried out.

Moved by Mr. Biggs, seconded by Mr. Richardson, and carried:

That the Chairman, Vice-Chairman, and Medical Officer of Health be authorised to order and have erected in such position as they may think suitable any tents which they may find to be requisite.

Moved by Mr. Richardson, seconded by Mr. Brady, and carried:

That the recommendation of the Medical Officer, that a caretaker be engaged for the quarantine wards, be adopted.

The Medical Officer of Health expresses his objection to any quarantine buildings of a permanent character being erected in proximity to the hospital.

20*th January* 1893.

Resolved:

That 10*s*. be paid to Mrs. Folwell for the clothing of her child, which died in the hospital, the clothing having been destroyed.

The report of the Fever Hospital Sub-committee as entered in the sub-committee minute book on pages 392 and 393 is read.

Moved, &c.:

That the report be approved.

Amendment:

That the report be approved, except that the Medical Officer of Health be authorised to furnish information to the newspapers as to small-pox daily.

The amendment is not carried and the motion is put and carried.

Resolved:

That Mr. Cowdell be engaged as architect for the proposed block of hospital buildings, and that he be instructed by the borough surveyor.

Resolved:

That the chairman be authorised to arrange for the use of one of the Corporation houses in the Newarke for temporary quarantine purposes if found desirable.

27*th January* 1893.

Resolved:

That the resolution passed by the Committee at the last meeting approving the report of the Fever Hospital Sub-Committee be rescinded so far as relates to furnishing the information to the Press in reference to small-pox, and that the Medical Officer of Health be authorised to give daily information to the Press.

Resolved:

That the information to be given to the Press be the number of the cases which occur each day and the locality of the cases.

Resolved:

That notices be given under sections five and six of the Infectious Diseases Prevention Act, 1890, where necessary with the object of securing effectual disinfection of infected houses and articles.

10*th February* 1893.

Resolved:

That Mr. Jayes of 78, Norfolk Street, be prosecuted for neglecting to notify a case of small-pox.

3*rd March* 1893.

Resolved:

That a further 30*s*. be paid to Mr. Raven in consideration of his additional loss in consequence of his having to remain.

The Town Clerk reports the prosecution on Monday last of Henry Jayes of Norfolk Street for neglecting to notify to the Corporation a case of small-pox at his house, when he was fined 1*l*., including costs.

10*th March* 1893.

Resolved:

That the Fever Hospital Sub-Committee meet on Wednesday next at 4 p.m. to consider the communication of the Local Government Board and as to the hospital expenses and that the meeting to consider as to the reports on the small-pox inquiry be deferred until the following week.

7*th April* 1893.

The report of the Fever Hospital and Zymotic Diseases Sub-Committee received by this Committee on the twenty-fourth March is again considered by the Committee, and it was—

Resolved:

That the report of the Sub-Committee be adopted by this Committee.

Further resolved:

That the report now adopted be presented by this Committee to the Council, and that a print be sent to each member of the Council, accompanied by prints of Dr. Priestley's Reports, and of the minutes of evidence and proceedings of the inquiry into the small-pox epidemic.

The Report of the Sub-Committee details the particulars of the first cases which occurred in the borough, and the history of the importation of small-pox into the fever wards so far as regards the case of E. K. (No. 7 in list), and makes the following recommendations:—

Your Committee are of opinion that the old quarantine wards, which are part of the main building of the scarlet fever blocks, should never be used for such purpose, being also in near proximity to the old small-pox ward; that if there is any quarantine carried out at the hospital, it should be in a building as far as possible from the other infections wards, with separate administration and laundry departments, and then only used in cases where householders can be placed whilst their homes are being thoroughly disinfected; and that all persons who have been known to have come in contact with small-pox cases should be visited as at present by the Sanitary Authority daily for 14 days. If any cases are at all doubtful, they should be then taken up to a part of the old erysipelas ward, which then might be used as a temporary observation ward.

We would also urge that if the old buildings are again used as a scarlet fever hospital, that there should be built in its near neighbourhood a block of buildings quite separate from the others, which could be used for watching doubtful cases of infectious diseases, and that the old small-pox ward, which is now worn out, should be destroyed.

The so-called quarantine system, as practised in Leicester during the present epidemic, has been as follows:—

First.—All persons who had been in contact with a person suffering from the disease were removed into the building, and presumably kept isolated there for 14 days. This is what is generally understood as the Leicester system. In practice it has been found that the persons so quarantined refused to keep within the building, but insisted on visiting homes in the neighbourhood, and associating with friends outside the hospital.

Secondly.—In other cases the person suffering from the disease was alone removed to the hospital, and the other residents of the house were requested to abstain from going about their ordinary business for 14 days, during which time they were daily visited by the sanitary inspectors. During this period compensation was awarded for loss of time, the weak point of this system being that although these people did not go to work, they moved about the town, and visited neighbbouring houses.

Thirdly.—On an outbreak of small-pox occurring in a common lodging-house, in which the sufferer had necessarily come into contact with a very large number of persons, no isolation was attempted, nor compensation given, but the persons were allowed to go about their daily vocation as usual, the system adopted to prevent the spread of small-pox being, that all of the sanitary inspectors visited the lodging-house daily, to see if anyone had fallen ill. If there was any case of sickness, the Sanitary Inspectors reported to the Medical Officer, who visited the case. In each of the above cases the houses were disinfected.

The system which we recommend has been alluded to in the former portion of our Report, viz.: that on a case of small-pox occurring, the patient should be at once removed to the hospital, and the other occupants of the house taken to a building apart from the Small-pox Hospital, and given a disinfecting bath, and their clothes disinfected. In the meantime, the dwelling-house and all therein should be thoroughly disinfected, and afterwards they should be allowed to return to their houses, but visited daily for 14 to 16 days by a Sanitary Inspector, who should report to the Medical Officer immediately any sickness occurred.

We recommend that stringent regulations be made as to all visitors to the Small-pox Hospital, and that no one should be allowed to examine a patient in the absence of the Medical Officer; further, that the Medical Officer take such precautions with regard to the nurses in charge of small-pox patients as he may think necessary, both before they leave the hospital for their necessary out-door exercise, or at other times.

We are also of opinion that all persons who are frequently brought into contact with small-pox patients should adopt all protective measures known to science.

14*th April* 1893.

It was resolved:

That the report on the small-pox inquiry, proposed at the last meeting and voted for by a minority of this Committee, be printed for the private use of the members of the Council, and a print sent to each member.

The report here alluded to also reviews the earlier history of the outbreak in the town, and in the hospital, and dwells upon the fact of the error in diagnosis whereby three children were known to have been infected, and to which, further, they attribute the spread of infection in the hospital. The following excerpts from this report sufficiently explain the views of those who adopted it upon the question of hospital accommodation:—

"Notwithstanding the allegation so frequently made, as to the unsuitability of the hospital for the treatment of more than one infectious disease, we would point out that when other outbreaks of small-pox have occurred during the past 20 years, the three wards of the main building were occupied by scarlet fever patients. The same conditions, therefore, existed as when this outbreak occurred, with this important exception, that previously the small-pox block which is new entirely detached, was then directly connected with the main corridor of the fever hospital, thus enhancing the risk of infection. It is true the fever wards were full of scarlet fever patients at the time this outbreak of small-pox took place, but it must be remembered that the whole of the small-pox block was available for small-pox cases, and was capable of accommodating 30 to 40 patients.

"From October 3rd to October 19th, there were only three patients in the small-pox wards. In the quarantine wards there were only five persons, all of one family, viz.:—Mrs. Kerrad and four children, two of the latter being removed into the fever hospital on the 11th and 12th of October, thus leaving only three in quarantine. It cannot therefore be maintained that either the small-pox or the quarantine parts of the hospital were overcrowded.

"The number of patients in the fever wards would not be of material importance, because, even if they had been occupied with only half the number, they would have been equally unavailable for small-pox patients. It has been alleged that the overcrowded state of the fever wards was the cause of the outbreak in them of small-pox. This cannot be maintained from the evidence, neither can it be affirmed that the risk of infection from small-pox would be very considerable, as there were only three patients in the hospital at the time.

"It is noticeable that whilst Ward No. 3 is most exposed to small-pox contagion, from being nearest to the small-pox block, the disease first broke out in No. 1 ward, which is at the greatest distance, and therefore least exposed to any contagion which might exist.

"Complaint has been made as to the absence of rooms for purposes of isolation at the hospital. Whilst we do not consider the hospital all that can be desired, we would point out that when Evelyn Kerrad first sickened there were at least two rooms—one in the quarantine block and one in the erysipelas block—both of which were entirely unoccupied. There was also another room available on emergency for the purpose of observation or isolation. One of these rooms was ready for immediate use, and the other two could have been prepared in a short time."

This report concluded as follows:—

"The experience of the present attack of small-pox has confirmed the value of what is known as the 'Leicester method' of dealing with variolous outbreaks. Had it not been for the efforts made in this direction we should no doubt have suffered more severely. In the Sanitary Committee, suggestions have been made from time to time, where improvements may be effected in the 'system,' and these will be acted upon in future. Upon these and other matters of a similar kind we make no recommendations, having limited this report to the object and scope of the inquiry."

21*st April* 1893.

The Medical Officer of Health reports that a deputation having waited upon him from the Thurmaston Local Board to request him to admit into the hospital a case of small-pox from their district, under the special circumstances of the case he consented to admit the patient.

Resolved:

That the action of the Medical Officer be approved, but that in future no cases of small-pox be admitted from the outside districts without the special consent of the Committee or the Chairman.

12*th May,* 1893.

Resolved:

That the course of procedure in reference to quarantine in connexion with small-pox now being pursued as reported by the Medical Officer to the sub-committee be continued for the present.

19*th May* 1893.

Resolved:

That payments amounting to 4*l.* 9*s.* be made to persons who are in quarantine at their houses.

23*rd June* 1893.

The Medical Officer reports in reference to the latest cases of small-pox which have arisen.

Resolved:

That the Chairman be requested to make a statement in the Council at the next meeting showing the difficulties in which the committee are placed in dealing with the outbreaks of small-pox.

30*th June* 1893.

Resolved:

That offers of land be invited by advertisement to lease with option of purchase for the erection of a hospital for the treatment of infectious diseases; also that the Estate Committee be asked if they can make an offer of any land for the purpose.

1*st September* 1893.

Resolved:

That 8*s.* be allowed to Mr. Hardy and 15*s.* to Mr. Tyler.

20*th October* 1893.

Resolved:

That the Committee approve of the site offered by the Sewage Farm Committee, and recommend it to the Council for approval if the approval of the owner can be obtained.

19*th January* 1894.

Resolved:

That 1*l.* be allowed to Mrs. Richardson, of 48, Wand Street, whose daughters have been kept from work in consequence of a case of small-pox occurring at her house.

Other allowances have been made on the recommendation of the accounts sub-committee.

RESOLUTIONS passed by the FEVER HOSPITAL SUB-COMMITTEE, and approved by the SANITARY COMMITTEE.

31*st October* 1892.

Resolved:

That in the opinion of this sub-committee the present arrangements for watching persons at their own houses when the hospital is full will be sufficient to meet the case.

1*st November* 1892.

Resolved:

That the parents of the children in quarantine be advised to attend at the hospital so that they may be informed of the danger of small-pox in the hospital, and asked if they wish their children to be brought home to-morrow (Wednesday) or would prefer to leave them at the hospital for the present.

Resolved:

That one of Humphrey's iron buildings (721) at an estimated cost of 170*l.* be purchased and ordered by telegraph to-day.

14*th December* 1892.

Resolved:

That the recent outbreak of small-pox in Leicester so far as it has proceeded be thoroughly investigated and reported upon by this sub-committee.

21*st December* 1892.

Resolved:

That the three scarlet fever wards be recommended to be utilised for the reception of small-pox patients.

Resolved:

That the sub-committee appointed at the last meeting of the Sanitary Committee be requested to consider and report to the Sanitary Committee what alterations and additions are required to enable the preceding resolution to be carried into effect.

14*th January* 1893.

The sub-committee visit a number of sites proposed for temporary quarantine buildings.

18*th January* 1893.

Resolved:

That the ordinary weekly return be regarded by this sub-committee as sufficient information to supply to newspapers respecting the present outbreak of small-pox.

22*nd March* 1893.

Resolved:

That the application of Mr. Pickering made through the Medical Officer of Health for the use of a ward at the hospital for making experiments in his mode of treatment of small-pox be not granted.

10*th May* 1893.

(*Report of Medical Officer.*)

The method that is now being carried out in Leicester in connexion with the treatment and prevention of small-pox outbreaks is as follows:—

1. The patient is removed at once to the borough fever hospital and the house (room or rooms), bedding, &c., disinfected.
2. The inmates of the infected house and others who may have come into contact with the small-pox case are placed under quarantine observation at their own homes being visited by the inspector daily for 16 days.
3. Any case of illness amongst these quarantined persons is at once notified to the medical officer, who visits the case and removes it to the hospital if necessary.
4. The inmates of infected houses and others who may have been in contact with the small-pox case if thought necessary, are strongly urged not to go to work for the whole or part of their quarantine period of 14–16 days, and during that time have been made such allowances as the sub-committee have thought fit, the sum advanced in each case being no more than sufficient to cover rent and maintenance. In the event of persons, however, being quarantined at the hospital as all their food is found for them, only such allowance has been made as would cover the rent, whilst in the event of clothes, bedding, &c., being destroyed fresh ones have been provided.
5. Persons whilst under quarantine observation are allowed to go about and are encouraged to take walks into the country, but are advised not to enter anybody's house, any public institution or meeting under penalty of forfeiting their monetary allowance
6. Quarantine wards within the same curtilage as small-pox wards may, in the opinion of some, be a source of danger to their inmates; this consideration, together with the largeness of the numbers to be dealt with has led me to watch the suspected people at their own homes.
7. Those inmates of infected houses who are willing are sent up to the hospital to have a disinfectant bath and to have their clothes stoved whilst their houses are fumigated wish sulphur meanwhile. Those persons who refuse to go up to the hospital have disinfectants given them and are asked to have a disinfectant bath at home.

Under conditions satisfactory to the Medical Officer of Health certain of the people from infected houses are allowed to continue at their work during the whole or part of their period of quarantine. In the case of a small-pox patient being a child recently attending school, the school manager is waited upon a list obtained of absentees who are then visited and the schoolroom if necessary fumigated. So, too, where the patient is at work in a factory or workshop, the names of the absentees from that factory or workshop are obtained and the absentees visited. The room or rooms in which the patient may have been at work, whilst in an infective stage, are, if thought necessary, fumigated.

14*th June* 1893.

The following letter from the Local Government Board is read:—

(Copy.)

Whitehall, S.W.,
Sir, 29th May 1893.

I am directed by the Local Government Board to advert to your letter of the 2nd instant with reference to the additional hospital accommodation proposed to be provided by the Town Council of Leicester.

The Board infer either that the reception of patients suffering from small-pox is contemplated in the new building which would be only 40 yards distant from the existing infectious diseases hospital or that the erection of the new building is concerned with the intended simultaneous reception in the hospital, of which this building will form a part, of cases of small-pox and cases of one or more other infectious diseases. Under these circumstances I am to point out that this is a course which in several instances during the prevalent epidemic of small-pox has been associated with the transmission of the disease to patients professedly under isolation for other infectious fevers. It has, moreover, been strongly condemned by the Royal Commission on Small-pox Hospitals, 1882. On page xxxii of the report made by that Commission the following paragraph appears: "It is evidently of paramount "importance that the areas of the small-pox wards as well "as their administration should be rigorously separated from "those of the fever hospitals, and further, that their "construction should be such as to reduce within the "smallest limits the chance of spreading infection."

If the Board were correct in their belief as to the object which the proposed building is intended to serve, I am to refer you to their letter of the 9th March and to say that they would not be prepared to sanction any loan in this case.

I am, Sir,
Your obedient Servant,
C. N. Dalton,
Assistant Secretary.

J. Storey, Esq.,
Town Clerk,
Leicester.

Resolved:

That the Town Clerk be requested to communicate with the Borough Members of Parliament asking them to speak with the President of the Local Government Board with a view to the holding of an inquiry in reference to the application made to the Board.

Resolved:

That it be left in the hands of the Chairman and the Medical Officer of Health to arrange for special accommodation for private patients suffering from small-pox if required and to fix a charge for their treatment.

31*st July* 1893.

Resolved:

That the small-pox cases now in the hospital be placed in the northern ward and that the vacated wards be made available for the reception of fever cases.

The sub-committee inspect the Hinckley Road site, the Beaumont Leys Farm site; some of the sub-committee visit the Leicester Frith site, and the Freake's Ground site; and the two sites on the Thurmaston Road are also visited.

Several other offers of land have been made as suitable sites for a new hospital.

11*th October* 1893.

Resolved:

That the sewage works and farms sub-committee be invited to meet the Sanitary Committee on Friday next at 4.30 to discuss the question of the proposed utilisation of land on Beaumont Leys as the site for a small-pox hospital.

§11. *Analytical Study of the Outbreak.*

The period embraced by this inquiry covers 70 weeks, reckoning from the week ending August 27th, 1892—the week in which arose the first case that came to the knowledge (subsequently) of the authorities. From that time, with but few exceptions, hardly a week elapsed without any cases arising, several of which were imported into the town, until the week ending December 23rd, 1893. In the subjoined table (and Chart III.) the number of persons attacked in each week is given, and also that of those who died, the deaths being those of the persons attacked in the week in question. The list includes not only the notified cases, but those which were not known to the authorities until later, and it comprises a total of 357, of whom 21 died.

TABLE XI.

LEICESTER, 1892–3.—WEEKLY INCIDENCE OF CASES OF SMALL-POX.

(*See also Chart III.*)*

—	Week ending—	Cases.	Deaths.
	1892.		
i	August 27	1	—
ii	September 3	—	—
iii	„ 10	3	1
iv	„ 17	—	—
v	„ 24	—	—
vi	October 1	1	—
vii	„ 8	1	—
viii	„ 15	2	—
ix	„ 22	2	—
x	„ 29	5	2
xi	November 5	5	1
xii	„ 12	1	1
xiii	„ 19	5	—
xiv	„ 26	2	—
xv	December 3	2	1
xvi	„ 10	3	—
xvii	„ 17	7	—
xviii	„ 24	2	—
xix	„ 31	6	—
	1893.		
xx	January 7	21	1
xxi	„ 14	11	—
xxii	„ 21	19	1
xxiii	„ 28	13	1
xxiv	February 4	12	1
xxv	„ 11	3	—
xxvi	„ 18	6	—
xxvii	„ 25	2	—
xxviii	March 4	5	—
xxix	„ 11	7	—
xxx	„ 18	2	—
xxxi	„ 25	5	—
xxxii	April 1	7	—
xxxiii	„ 8	7	—
xxxiv	„ 15	12	—
xxxv	„ 22	7	2
xxxvi	„ 29	10	1
xxxvii	May 6	7	1
xxxviii	„ 13	14	—
xxxix	„ 20	7	—
xl	„ 27	10	—
xli	June 3	10	1
xlii	„ 10	10	—
xliii	„ 17	19	—
xliv	„ 24	11	—
xlv	July 1	5	1
xlvi	„ 8	7	—
xlvii	„ 15	2	—
xlviii	„ 32	2	—
xlix	„ 29	6	—
l	August 5	2	—
li	„ 12	5	1
lii	„ 19	2	1
liii	„ 26	2	—
liv	September 2	2	—
lv	„ 9	2	—
lvi	„ 16	5	—
lvii	„ 23	5	—
lviii	„ 30	—	—
lix	October 7	2	—
lx	„ 14	3	—
lxi	„ 21	1	—
lxii	„ 28	2	1
lxiii	November 4	1	—
lxiv	„ 11	—	—
lxv	„ 18	2	—
lxvi	„ 25	5	1
lxvii	December 2	2	—
lxviii	„ 9	3	1
lxix	„ 16	2	—
lxx	„ 23	2	—
		357	21

In Table XII. the cases are distributed amongst the months of their incidence, and it will be seen that the outbreak attained its height in January 1893, but that the disease was also disproportionately prevalent in the months of May and June.

TABLE XII.

LEICESTER.—SMALL-POX, 1892–3.

Monthly Incidence. (CHART IV. A.)

N.B.—Cases entered in month of onset of illness.

—	Cases.	Deaths.
1892.		
August	1	—
September	5	1
October	10	2
November	13	2
December	18	1
1893.		
January	69	4
February	20	—
March	24	—
April	39	4
May	43	1
June	48	1
July	18	—
August	12	2
September	12	—
October	8	1
November	10	1
December	7	1
	357	21

Sex and Age.—The number of males attacked with small-pox was 181; of females, 176. The mortality, however, was far higher in the female sex, viz., 14 deaths, or nearly 8 per cent., as compared with 7 deaths, or 3·8 per cent. of the males.

TABLE XIII.

LEICESTER.—SMALL-POX, 1892–3.

TABLE SHOWING AGES OF THOSE ATTACKED IN EACH MONTH. (CHART IV. B.)

—	Under 1 Year.		1 to 10 Years.		10 to 30 Years.		30 Years and upwards.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1892.								
August	—	—	—	—	—	—	1	—
September	1	—	—	—	2	—	2	1
October	—	—	6	2	2	—	2	—
November	—	—	7	1	1	—	5	1
December	—	—	6	1	8	—	4	—
1893.								
January	1	1	18	3	38	—	12	—
February	—	—	6	—	7	—	7	—
March	—	—	3	—	10	—	11	—
April	1	—	14	3	15	1	9	—
May	1	—	9	—	21	1	12	—
June	1	—	14	—	22	—	11	1
July	—	—	1	—	12	—	5	—
August	2	1	5	1	4	—	1	—
September	—	—	4	—	7	—	1	—
October	—	—	1	—	6	1	1	—
November	—	—	4	1	3	—	3	—
December	—	—	4	1	3	—	—	—
	7	2	102	13	161	3	87	3

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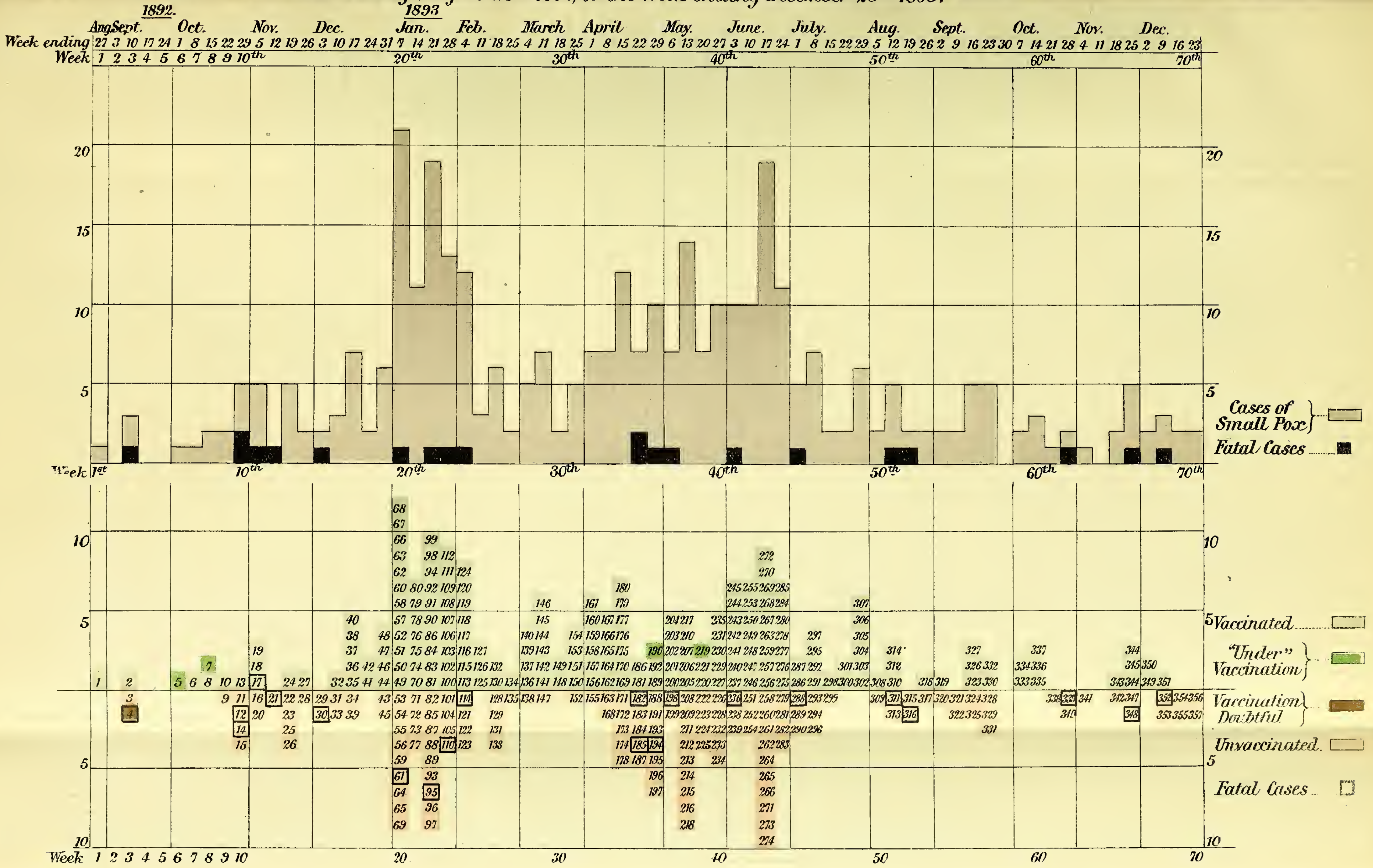
* *Explanation of Chart III.:—*

This chart shows the number of cases (and deaths) arising in each week of the outbreak. In the lower portion of the chart the vaccination conditions are indicated. (See *Table* XVII).

ending August 27th 1892, to the week ending December 23rd 1893.



To face page 42.

The age-distribution (see Tables XIII. and XIV.) shows that for both sexes—the largest number of cases in any decade—was from 0 to 10 years, viz., 109; the next at from 20 to 30, viz., 92; and the next from 10 to 20, viz., 69. In Table XIII. the relative monthly incidence of the disease amongst persons of different ages is shown, and (excluding August 1892) it will be found that, taking four periods of four months' each, the proportion of those attacked between the ages of 1 and 10 years was respectively 41·3 per cent., 26·9 per cent., 24·8 per cent., and 35·1 per cent., the preponderance at those ages during the first period being ascribable to the children who were infected in the hospital fever wards.

TABLE XIV.

SMALL-POX.—AGE AND SEX DISTRIBUTION.

—	Males.		Females.		Both Sexes.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	2	—	5	2	7	2
1 to 5 years	17	2	18	5	35	7
5 to 10 „	28	2	39	4	67	6
10 to 15 „	17	1	19	—	36	1
15 to 20 „	16	—	17	—	33	—
20 to 30 „	44	1	48	1	92	2
30 to 40 „	27	—	18	1	45	1
40 to 50 „	17	—	10	1	27	1
50 to 60 „	8	1	2	—	10	1
60 to 70 „	4	—	—	—	4	—
70 and over	1	—	—	—	1	—
	181	7	176	14	357	21

Stated in Age-periods, the above figures would run :—

—	Males.		Females.		Both Sexes.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
At ages under 1 year	2	0	5	2	7	2
„ 1 to 10 years	45	4	57	9	102	13
„ 10 to 30 „	77	2	84	1	161	3
„ 30 years and upwards	57	1	30	2	87	3
	181	7	176	14	357	21

Type of Attacks.—Of the whole number of cases 7 were regarded as *malignant* (hæmorrhagic type), all of which were fatal; 89 may be considered as of *confluent* type, 14 fatal, 56 as *coherent*, 78 as *discrete*, whilst in no fewer than 127 the disease was *mild* in its course and sparse in the eruption.

The per-centage distribution was, therefore, as follows :—

Malignant	1·9 per cent.
Confluent	24·9 „
Coherent	15·6 „
Discrete	21·8 „
Mild	35·5 „

It is of interest to note that, if the period (exclusive of August 1892) be divided into four terms of four months each, the severer cases—malignant and confluent—predominated in the first and last of these terms (*see* Table XV.), being 45·6 per cent., 19 per cent., 24·7 per cent., and 43·2 per cent. respectively. This variation bears some correspondence with the variation in incidence in children, already mentioned, for from Table XVI. it appears that the highest numbers, absolute and relative, of severe cases were met with in the young.

TABLE XV.

LEICESTER.—SMALL-POX, 1892–3.

TABLE SHOWING PROPORTIONATE TYPE OF DISEASE IN EACH MONTH. (CHART IV. C.)

—	Malignant.		Confluent.		Coherent.		Discrete.		Mild.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1892. August	—	—	—	—	—	—	—	—	1	—	1	—
September	—	—	3	1	—	—	1	—	1	—	5	1
October	1	1	5	1	2	—	1	—	1	—	10	2
November	—	—	8	2	3	—	1	—	1	—	13	2
December	—	—	4	1	3	—	4	—	7	—	18	1
1893. January	1	1	13	3	10	—	13	—	32	—	69	4
February	—	—	4	—	4	—	3	—	9	—	20	—
March	—	—	2	—	2	—	9	—	11	—	24	—
April	2	2	7	2	9	—	10	—	11	—	39	4
May	1	1	10	—	9	—	11	—	12	—	43	1
June	—	—	12	1	6	—	14	—	16	—	48	1
July	—	—	2	—	5	—	4	—	7	—	18	—
August	—	—	5	2	—	—	2	—	5	—	12	2
September	—	—	5	—	—	—	1	—	6	—	12	—
October	—	—	2	1	—	—	2	—	4	—	8	1
November	1	1	4	—	2	—	1	—	2	—	10	1
December	1	1	3	—	1	—	1	—	1	—	7	1
	7	7	89	14	56	—	78	—	127	—	357	21

TABLE XVI.

TYPE OF SMALL-POX.—AGE DISTRIBUTION.

—	Malignant.		Confluent.		Coherent.		Discrete.		Mild.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year	1	1	2	1	3	—	—	—	1	—	7	2
1–5	2	2	17	5	8	—	4	—	4	—	35	7
5–10	2	2	30	4	12	—	16	—	7	—	67	6
10–15	1	1	9	—	7	—	9	—	10	—	36	1
15–20	—	—	6	—	3	—	4	—	20	—	33	—
20–30	1	1	11	1	10	—	19	—	51	—	92	2
30–40	—	—	7	1	6	—	17	—	15	—	45	1
40–50	—	—	6	1	4	—	4	—	13	—	27	1
50–60	—	—	1	1	3	—	2	—	4	—	10	1
60–70	—	—	—	—	—	—	3	—	1	—	4	—
70 and over	—	—	—	—	—	—	—	—	1	—	1	—
	7	7	89	14	56	—	78	—	127	—	357	21

Thus at ages :—

—	Under 1 Year.	1 to 10 Years.	10 to 30 Years.	30 Years and upwards.
	Per cent.	Per cent.	Per cent.	Per cent.
Malignant	1 or 14·3	4 or 3·9	2 or 1·2	0 —
Confluent	2 or 28·6	47 or 46·0	26 or 16·1	14 or 16·1
Coherent	3 or 42·8	20 or 19·6	20 or 12·4	13 or 15·0
Discrete	0 —	20 or 19·6	32 or 19·9	26 or 29·8
Mild	1 or 14·3	11 or 10·7	81 or 50·3	34 or 39·1
	7	102	161	87

Vaccination Data of those Attacked with Small-pox.

In Table XVII. and Chart II. the weekly totals are divided into four categories, according to the condition of the subjects *quâ* vaccination. These categories consist of (*a*) those presenting evidence of having been vaccinated; (*b*) those undergoing primary vaccination when attacked; (*c*) where the fact of vaccination was uncertain or doubtful; and (*d*) the unvaccinated.

TABLE XVII.

VACCINATION DATA OF CASES arising in each Week.

(CHART III.)

Week.	Vaccinated.		Under-Vaccination.		Doubtful Vaccination.		Un-vaccinated.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
i	1	—	—	—	—	—	—	—
ii	—	—	—	—	—	—	—	—
iii	1	—	—	—	1	1	1	—
iv	—	—	—	—	—	—	—	—
v	—	—	—	—	—	—	—	—
vi	—	—	1	—	—	—	—	—
vii	1	—	—	—	—	—	—	—
viii	1	—	1	—	—	—	—	—
ix	1	—	—	—	—	—	1	—
x	1	—	—	—	—	—	4	2
xi	3	1	—	—	—	—	2	—
xii	—	—	—	—	—	—	1	1
xiii	1	—	—	—	—	—	4	—
xiv	1	—	—	—	—	—	1	—
xv	—	—	—	—	—	—	2	1
xvi	1	—	—	—	—	—	2	—
xvii	5	—	—	—	—	—	2	—
xviii	2	—	—	—	—	—	—	—
xix	4	—	—	—	—	—	2	—
xx	12	—	—	—	—	—	9	1
xxi	7	—	—	—	—	—	4	—
xxii	10	—	—	—	—	—	9	1
xxiii	9	—	—	—	—	—	4	1
xxiv	8	—	—	—	—	—	4	1
xxv	3	—	—	—	—	—	—	—
xxvi	2	—	—	—	—	—	4	—
xxvii	1	—	—	—	—	—	1	—
xxviii	4	—	—	—	—	—	1	—
xxix	6	—	—	—	—	—	1	—
xxx	2	—	—	—	—	—	—	—
xxxi	4	—	—	—	—	—	1	—
xxxii	6	—	—	—	—	—	1	—
xxxiii	5	—	—	—	—	—	2	—
xxxiv	7	—	—	—	—	—	5	—
xxxv	2	—	—	—	—	—	5	
xxxvi	2	—	1	—	—	—	7	1
xxxvii	5	—	—	—	—	—	2	1
xxxviii	5	—	—	—	—	—	9	—
xxxix	2	—	1	—	—	—	4	—
xl	5	—	—	—	—	—	5	—
xli	7	—	—	—	—	—	3	1
xlii	7	—	—	—	—	—	3	—
xliii	9	—	—	—	—	—	10	—
xliv	7	—	—	—	—	—	4	—
xlv	2	—	—	—	—	—	3	1
xlvi	4	—	—	—	—	—	3	—
xlvii	1	—	—	—	—	—	1	—
xlviii	2	—	—	—	—	—	—	—
xlix	6	—	—	—	—	—	—	—
l	1	—	—	—	—	—	1	—
li	3	—	—	—	—	—	2	1
lii	—	—	—	—	—	—	2	1
liii	1	—	—	—	—	—	1	—
liv	1	—	—	—	—	—	1	—
lv	—	—	—	—	—	—	2	—
lvi	3	—	—	—	—	—	2	—
lvii	2	—	—	—	—	—	3	—
lviii	—	—	—	—	—	—	—	—
lix	2	—	—	—	—	—	—	—
lx	3	—	—	—	—	—	—	—
lxi	—	—	—	—	—	—	1	—
lxii	—	—	—	—	—	—	2	1
lxiii	—	—	—	—	—	—	1	—
lxiv	—	—	—	—	—	—	—	—
lxv	1	—	—	—	—	—	1	—
lxvi	3	—	—	—	—	—	2	1
lxvii	2	—	—	—	—	—	—	—
lxviii	1	—	—	—	—	—	2	1
lxix	—	—	—	—	—	—	2	—
lxx	—	—	—	—	—	—	2	—
	198	1	4	—	1	1	154	19

Thus the vaccinated numbered 198, or 55·4 per cent. of all attacked; those "under vaccination," 4, or 1·1 per cent.; "doubtful" vaccination, 1, or 0·2 per cent.; unvaccinated, 154, or 43·1 per cent.

The mortality amongst the vaccinated was 0·8 per cent.; amongst the unvaccinated, 12·3 per cent. The single case in which the fact of vaccination was doubtful proved fatal (No. 4, v. *ante*). There were no deaths amongst the four who were "under" vaccination.

TABLE XVIII.

LEICESTER.—SMALL-POX, 1892–3.

MONTHLY INCIDENCE.—VACCINATION DATA.

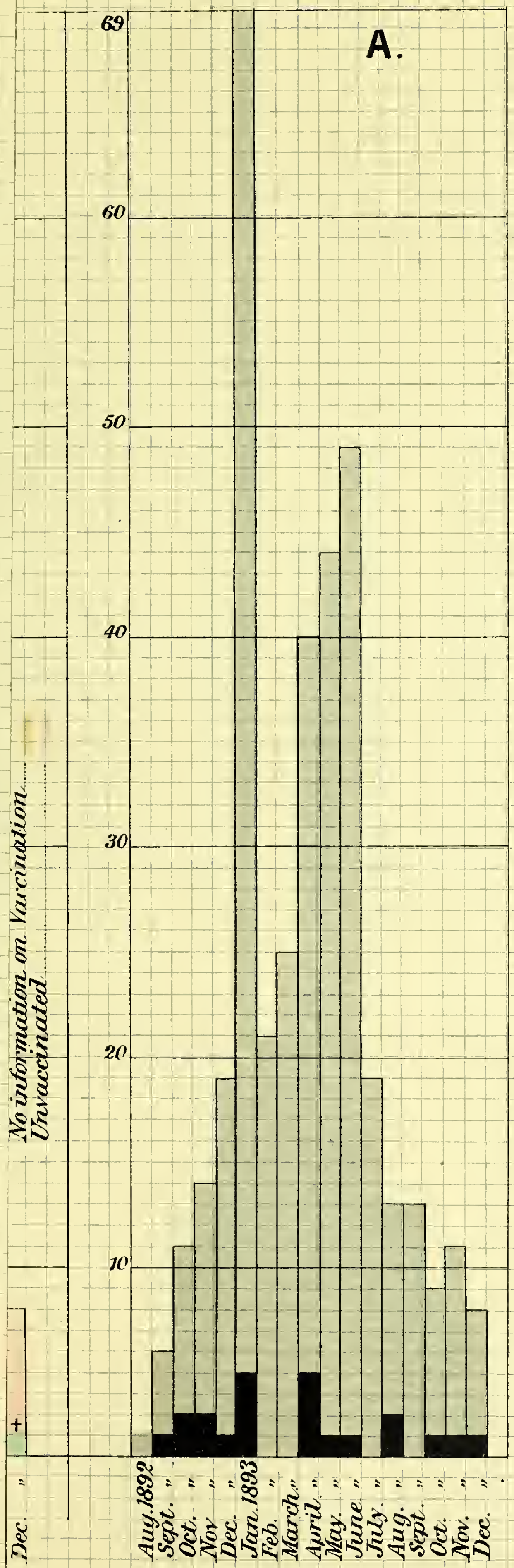
(CHART IV. D.)

Month.	Vaccinated		Under Vacci-nation.		Doubtful Vacci-nation.		Un-vacci-nated.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1892. August - -	1	—	—	—	—	—	—	—
September - -	2	—	1	—	1	1	1	—
October - -	3	—	1	—	—	—	6	2
November - -	5	1	—	—	—	—	8	1
December - -	11	—	—	—	—	—	7	1
1893. January - -	42	—	—	—	—	—	27	4
February - -	12	—	—	—	—	—	8	—
March - -	20	—	—	—	—	—	4	—
April - -	17	—	1	—	—	—	21	4
May - -	21	—	1	—	—	—	21	1
June - -	28	—	—	—	—	—	20	1
July - -	14	—	—	—	—	—	4	—
August - -	5	—	—	—	—	—	7	2
September - -	5	—	—	—	—	—	7	—
October - -	5	—	—	—	—	—	3	1
November - -	6	—	—	—	—	—	4	1
December - -	1	—	—	—	—	—	6	1
	198	1	4	—	1	1	154	19

Explanation of Chart IV:—

In this chart the monthly distribution of the cases of small-pox is represented. A.—Total numbers and mortality. B.—Numbers at different age-periods. C.—Numbers of different types of the disease. D. Numbers vaccinated and unvaccinated. The fatal cases in B., C., and D., shown by the sign +.

Chart IV.



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Vaccination Data of those Attacked with Small-pox.

In Table XVII. and Chart II. the weekly totals are divided into four categories, according to the condition of the subjects *quâ* vaccination. These categories consist of (*a*) those presenting evidence of having been vaccinated; (*b*) those undergoing primary vaccination when attacked; (*c*) where the fact of vaccination was uncertain or doubtful; and (*d*) the unvaccinated.

TABLE XVII.

VACCINATION DATA OF CASES arising in each Week.
(CHART III.)

Week.	Vaccinated.		Under-Vaccination.		Doubtful Vaccination.		Un-vaccinated.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
i	1	—	—	—	—	—	—	—
ii	—	—	—	—	—	—	—	—
iii	1	—	—	—	1	1	1	—
iv	—	—	—	—	—	—	—	—
v	—	—	—	—	—	—	—	—
vi	—	—	1	—	—	—	—	—
vii	1	—	—	—	—	—	—	—
viii	1	—	1	—	—	—	—	—
ix	1	—	—	—	—	—	1	—
x	1	—	—	—	—	—	4	2
xi	3	1	—	—	—	—	2	—
xii	—	—	—	—	—	—	1	1
xiii	1	—	—	—	—	—	4	—
xiv	1	—	—	—	—	—	1	—
xv	—	—	—	—	—	—	2	1
xvi	1	—	—	—	—	—	2	—
xvii	5	—	—	—	—	—	2	—
xviii	2	—	—	—	—	—	—	—
xix	4	—	—	—	—	—	2	—
xx	12	—	—	—	—	—	9	1
xxi	7	—	—	—	—	—	4	—
xxii	10	—	—	—	—	—	9	1
xxiii	9	—	—	—	—	—	4	1
xxiv	8	—	—	—	—	—	4	1
xxv	3	—	—	—	—	—	—	—
xxvi	2	—	—	—	—	—	4	—
xxvii	1	—	—	—	—	—	1	—
xxviii	4	—	—	—	—	—	1	—
xxix	6	—	—	—	—	—	1	—
xxx	2	—	—	—	—	—	—	—
xxxi	4	—	—	—	—	—	1	—
xxxii	6	—	—	—	—	—	1	—
xxxiii	5	—	—	—	—	—	2	—
xxxiv	7	—	—	—	—	—	5	—
xxxv	2	—	—	—	—	—	5	
xxxvi	2	—	1	—	—	—	7	1
xxxvii	5	—	—	—	—	—	2	1
xxxviii	5	—	—	—	—	—	9	—
xxxix	2	—	1	—	—	—	4	—
xl	5	—	—	—	—	—	5	—
xli	7	—	—	—	—	—	3	1
xlii	7	—	—	—	—	—	3	—
xliii	9	—	—	—	—	—	10	—
xliv	7	—	—	—	—	—	4	—
xlv	2	—	—	—	—	—	3	1
xlvi	4	—	—	—	—	—	3	—
xlvii	1	—	—	—	—	—	1	—
xlviii	2	—	—	—	—	—	—	—
xlix	6	—	—	—	—	—	—	—
l	1	—	—	—	—	—	1	—

VACCINATION DATA OF CASES arising in each Week—*cont.*

Week.	Vaccinated.		Under Vaccination.		Doubtful Vaccination.		Un-vaccinated,	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
li	3	—	—	—	—	—	2	1
lii	—	—	—	—	—	—	2	1
liii	1	—	—	—	—	—	1	—
liv	1	—	—	—	—	—	1	—
lv	—	—	—	—	—	—	2	—
lvi	3	—	—	—	—	—	2	—
lvii	2	—	—	—	—	—	3	—
lviii	—	—	—	—	—	—	—	—
lix	2	—	—	—	—	—	—	—
lx	3	—	—	—	—	—	—	—
lxi	—	—	—	—	—	—	1	—
lxii	—	—	—	—	—	—	2	1
lxiii	—	—	—	—	—	—	1	—
lxiv	—	—	—	—	—	—	—	—
lxv	1	—	—	—	—	—	1	—
lxvi	3	—	—	—	—	—	2	1
lxvii	2	—	—	—	—	—	—	—
lxviii	1	—	—	—	—	—	2	1
lxix	—	—	—	—	—	—	2	—
lxx	—	—	—	—	—	—	2	—
	198	1	4	—	1	1	154	19

Thus the vaccinated numbered 198, or 55·4 per cent. of all attacked; those "under vaccination," 4, or 1·1 per cent.; "doubtful" vaccination, 1, or 0·2 per cent.; unvaccinated, 154, or 43·1 per cent.

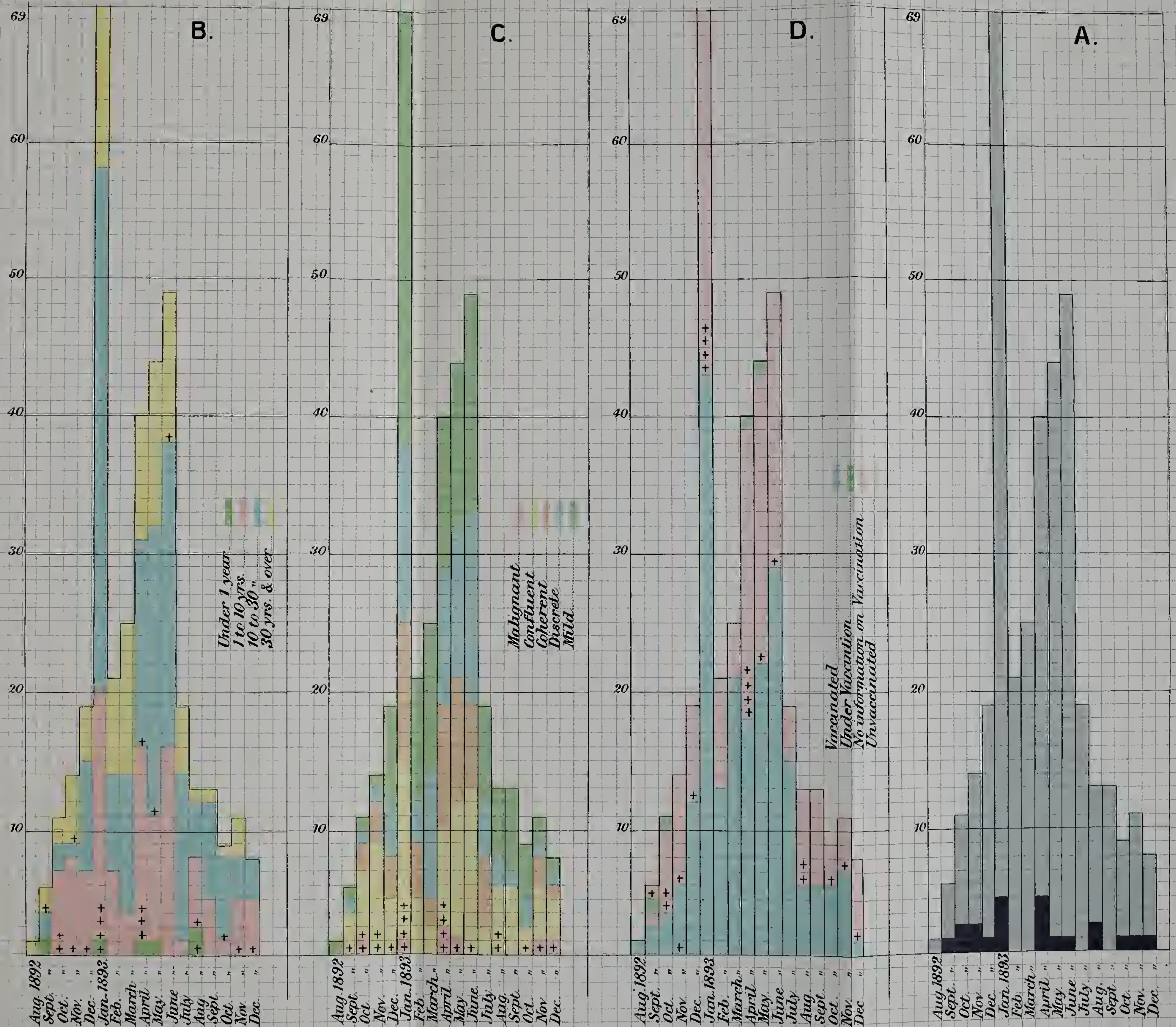
The mortality amongst the vaccinated was 0·8 per cent.; amongst the unvaccinated, 12·3 per cent. The single case in which the fact of vaccination was doubtful proved fatal (No. 4, v. *ante*). There were no deaths amongst the four who were "under" vaccination.

TABLE XVIII.
LEICESTER.—SMALL-POX, 1892–3.
MONTHLY INCIDENCE.—VACCINATION DATA.
(CHART IV. D.)

Month.	Vaccinated		Under Vacci-nation.		Doubtful Vacci-nation.		Un-vacci-nated.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
1892. August - -	1	—	—	—	—	—	—	—
September - -	2	—	1	—	1	1	1	—
October - -	3	—	1	—	—	—	6	2
November - -	5	1	—	—	—	—	8	1
December - -	11	—	—	—	—	—	7	1
1893. January - -	42	—	—	—	—	—	27	4
February - -	12	—	—	—	—	—	8	—
March - -	20	—	—	—	—	—	4	—
April - -	17	—	1	—	—	—	21	4
May - -	21	—	1	—	—	—	21	1
June - -	28	—	—	—	—	—	20	1
July - -	14	—	—	—	—	—	4	—
August - -	5	—	—	—	—	—	7	2
September - -	5	—	—	—	—	—	7	—
October - -	5	—	—	—	—	—	3	1
November - -	6	—	—	—	—	—	4	1
December - -	1	—	—	—	—	—	6	1
	198	1	4	—	1	1	154	19

Explanation of Chart IV:—
In this chart the monthly distribution of the cases of small-pox is represented. A.—Total numbers and mortality. B.—Numbers at different age-periods. C.—Numbers of different types of the disease. D. Numbers vaccinated and unvaccinated. The fatal cases in B., C., and D., shown by the sign +.

Chart IV.



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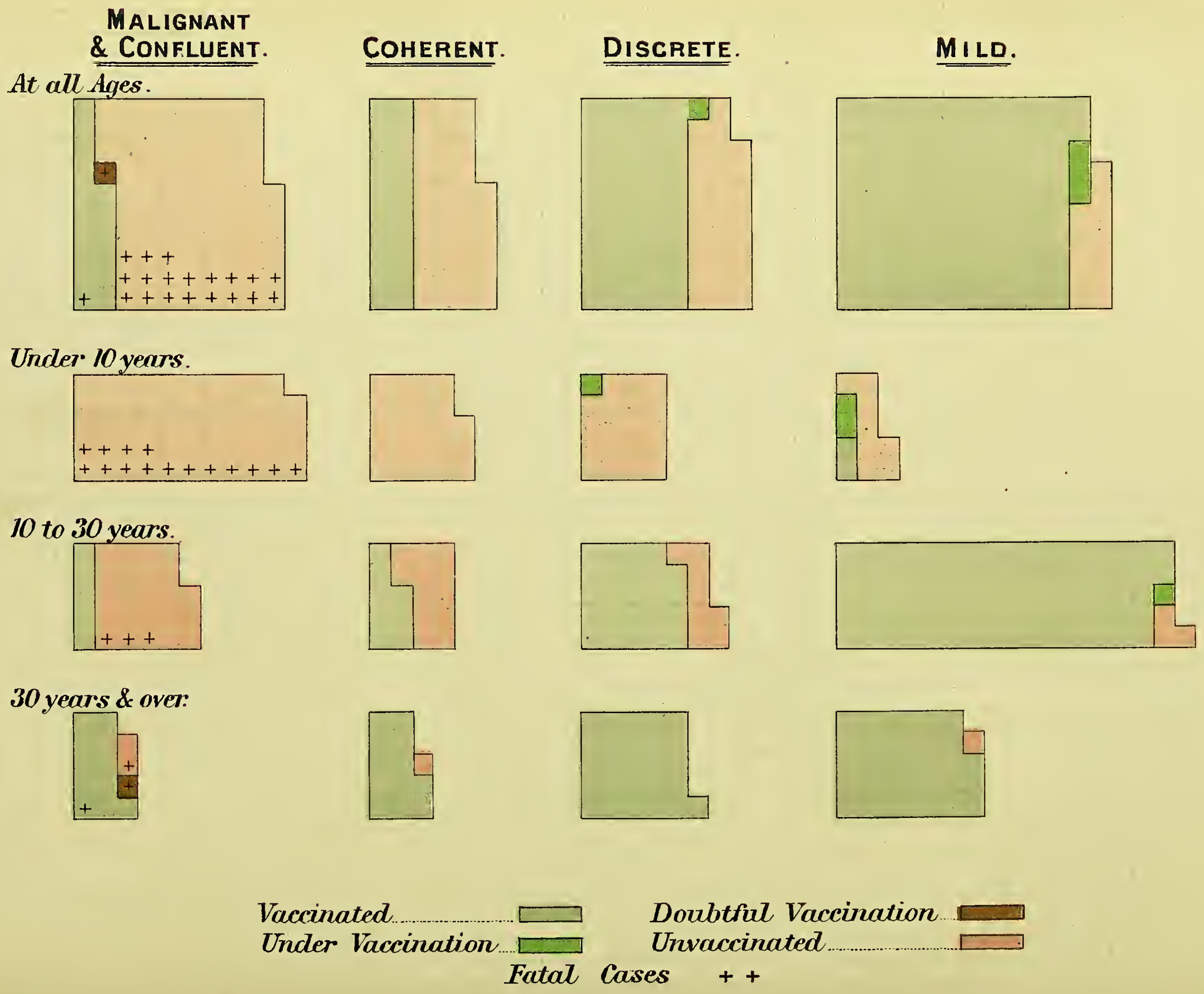
LEICESTER, 1892-93.

Type and Fatality of Small Pox in regard to Age & Vaccination



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In Table XVIII. the data furnished in Table XVII. are arranged in the months of the occurrence of the cases.

Dividing the whole period—September 1892 to December 1893—into four terms of four months each, it will be found that the proportion of vaccinated and unvaccinated in each term was as follows:—Vaccinated, 45·6 per cent., 60 per cent., 56 per cent., and 46 per cent.; unvaccinated, 48 per cent., 39·4 per cent., 43 per cent., and 54 per cent.

§12. *Vaccination in Relation to Type of Attack.*

In Tables XIX. and XX. and Chart V. the facts as to the relative incidence of the different forms of small-pox in the various classes of vaccinated and unvaccinated are set forth. These figures show that in children, who, with four exceptions, were all unvaccinated, the proportion of severe cases was very much higher than in adults, amongst whom the proportions of vaccinated and unvaccinated were almost reversed; and that above the age of 30 twice as many confluent cases occurred amongst the vaccinated class than below that age.

TABLE XIX.

CASES OF SMALL-POX.

AGE AND VACCINATION.

—	Vaccinated.		Under Vaccination.		Doubtful Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
Under 1 year -	—	—	1	—	—	—	6	2	7	2
1 to 5 years -	—	—	1	—	—	—	34	7	35	7
5 „ 10 „ -	2	—	1	—	—	—	64	6	67	6
10 „ 15 „ -	9	—	—	—	—	—	27	1	36	1
15 „ 20 „ -	24	—	1	—	—	—	8	—	33	—
20 „ 30 „ -	81	—	—	—	—	—	11	2	92	2
30 „ 40 „ -	44	—	—	—	—	—	1	1	45	1
40 „ 50 „ -	24	1	—	—	—	—	3	—	27	1
50 „ 60 „ -	9	—	—	—	1	1	—	—	10	1
60 „ 70 „ -	4	—	—	—	—	—	—	—	5	—
70 and over -	1	—	—	—	—	—	—	—	1	—
	198	1	4	—	1	1	154	19	357	21

TABLE XX.

VACCINATION and TYPE of SMALL-POX.

—	Vaccinated.					Under Vaccination.					Doubtful Vaccination.					Un-vaccinated.					Total.					—
	Malignant.	Confluent.	Coherent.	Discrete.	Mild.	Malignant.	Confluent.	Coherent.	Discrete.	Mild.	Malignant.	Confluent.	Coherent.	Discrete.	Mild.	Malignant.	Confluent.	Coherent.	Discrete.	Mild.	Malignant.	Confluent.	Coherent.	Discrete.	Mild.	
Under 1 year - -										1						1	2	3			1	2	3		1	7
1 to 5 - - -										1						2	17	8	4	3	2	17	8	4	4	35
5 „ 10 - - -					2				1							2	30	12	15	5	2	30	12	16	7	67
10 „ 15 - - -				2	7											1	9	7	7	3	1	9	7	9	10	36
15 „ 20 - - -		1	1	3	19					1							5	2	1			6	3	4	20	33
20 „ 30 - - -		4	7	19	51											1	7	3			1	11	10	19	51	92
30 „ 40 - - -		6	6	17	15												1					7	6	17	15	45
40 „ 50 - - -		5	3	4	12												1	1		1		6	4	4	13	27
50 „ 60 - - -			3	2	4							1										1	3	2	4	10
60 „ 70 - - -				3	1																			3	1	4
70 and over - -					1																				1	1
	—	16	20	50	112				1	3		1				7	72	36	27	12	7	89	56	78	127	357

And stated in age periods (*see* Chart IV.):—

TABLE XX. A.

—	Vaccinated.		Under Vaccination.		Doubtful Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
0 *to* 10 *years*:—										
Malignant - - -	—	—	—	—	—	—	5	5	5	5
Confluent - - -	—	—	—	—	—	—	49	10	49	10
Coherent - - -	—	—	—	—	—	—	23	—	23	—
Discrete - - -	—	—	1	—	—	—	19	—	20	—
Mild - - -	2	—	2	—	—	—	8	—	12	—
	2	—	3	—	—	—	104	15	109	15
10 *to* 30 *years*:—										
Malignant - - -	—	—	—	—	—	—	2	2	2	2
Confluent - - -	5	—	—	—	—	—	21	1	26	1
Coherent - - -	8	—	—	—	—	—	12	—	20	—
Discrete - - -	24	—	—	—	—	—	8	—	32	—
Mild - - -	77	—	1	—	—	—	3	—	81	—
	114	—	1	—	—	—	46	3	161	3

Explanation of Chart V.:—
This Chart shows the absolute number of cases of each type in each class.

TABLE XX A.—*continued.*

——	Vaccinated.		Under Vaccination.		Doubtful Vaccination.		Unvaccinated.		Total.	
	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.	Cases.	Deaths.
30 *years and over*:—										
Malignant - - -	—	—	—	—	—	—	—	—	—	—
Confluent - - -	11	1	—	—	1	1	2	1	14	3
Coherent - - -	12	—	—	—	—	—	1	—	13	—
Discrete - - -	26	—	—	—	—	—	—	—	26	—
Mild - - -	33	—	—	—	—	—	1	—	34	—
	82	1	—	—	1	1	4	1	87	3
At all ages:—										
Malignant - - -	—	—	—	—	—	—	7	7	7	7
Confluent - - -	16	1	—	—	1	1	72	12	89	14
Coherent - - -	20	—	—	—	—	—	36	—	56	—
Discrete - - -	50	—	1	—	—	—	27	—	78	—
Mild - - -	112	—	3	—	—	—	12	—	127	—
	198	1	4	—	1	1	154	19	357	21

Comparison of Vaccinated and Unvaccinated as to Type of Attack.

In analysing the proportionate distribution of the cases of small-pox at different age-periods, we have the following results, which are represented diagrammatically on the accompanying plan (Chart VI.):—

Vaccinated Class (198 Cases).

Type of Small-pox.	Under 10 Years.	10 to 30 Years.	30 Years and upwards.	At all Ages.
Confluent -	—	5 or 4·4 p.c.	11 or 13·4 p.c.	16 or 8·0 p.c.
Coherent -	—	8 „ 7·0 „	12 „ 14·6 „	20 „ 10·1 „
Discrete -	—	24 „ 21·0 „	26 „ 31·7 „	50 „ 25·2 „
Mild - -	2 or 100 p.c.	77 „ 67·5 „	33 „ 40·2 „	112 „ 56.5 „
	2	114	82	198

Of this total, 182 have the number of primary vaccination cicatrices recorded—viz.: 6 with 1 cicatrix, 42 with 2 cicatrices, 64 with 3 cicatrices, and 70 with 4 or more cicatrices.

Having One Primary Vaccination Cicatrix (6 Cases).

Type of Small-pox.	Under 10 Years.	10 to 30 Years.	30 Years and upwards.	At all Ages.
Confluent -	No Cases.	1 or 20·0 p.c.	—	1 or 16·6 p.c.
Coherent -		1 „ 20·0 „	—	1 „ 16·6 „
Discrete -		1 „ 20·0 „	—	1 „ 16·6 „
Mild - -		2 „ 40·0 „	1 or 100 p.c.	3 „ 50·0 „
		5	1	6 „ 50·0 „

Having Two Primary Vaccination Cicatrices (42 Cases).

Type of Small-pox.	Under 10 Years.	10 or 30 Years.	30 Years and upwards.	At all Ages.
Confluent -	No Cases.	2 or 8·7 p.c.	6 or 31·6 p.c.	8 or 19·0 p.c.
Coherent -		—	3 „ 15·8 „	3 „ 7·0 „
Discrete -		5 „ 21·7 „	6 „ 31·6 „	11 „ 26·2 „
Mild - -		16 „ 69·5 „	4 „ 21·0 „	20 „ 47·6 „
		23	19	42

Having Three Primary Vaccination Cicatrices (64 Cases).

Type of Small-pox.	Under 10 Years.	10 to 30 Years.	30 Years and upwards.	At all Ages.
Confluent -	No Cases.	1 or 3·4 p.c.	4 or 11·4 p.c.	5 or 7·8 p.c.
Coherent -		4 „ 13·8 „	6 „ 17·1 „	10 „ 15·6 „
Discrete -		6 „ 20·0 „	13 „ 37·0 „	19 „ 29·7 „
Mild - -		18 „ 62·1 „	12 „ 34·3 „	30 „ 46·9 „
		29	35	64

Having Four or more Primary Vaccination Cicatrices (70 Cases).

Type of Small-pox.	Under 10 Years.	10 to 30 Years.	30 Years and upwards.	At all Ages.
Confluent -	—	1 or 1·9 p.c.	1 or 6·0 p.c.	2 or 2·8 p.c.
Coherent -	—	3 „ 5·9 „	3 „ 17·6 „	6 „ 8·5 „
Discrete -	—	11 „ 21·5 „	5 „ 29·4 „	16 „ 22·8 „
Mild - -	2	36 „ 70·6 „	8 „ 47·0 „	46 „ 65·7 „
		51	17	70

These figures, small as they are, show a general proclivity to a greater proportion of severe cases beyond the age of 30 years than below it; and also a diminishing ratio of these severe cases in each age-period *pari passu* with an increase in the number of vaccination cicatrices.

These results may be contrasted with those yielded by a similar analysis of the unvaccinated subjects.

Unvaccinated Class (154 Cases).

Type of Small-pox.	Under 10 Years.	10 to 30 Years.	30 Years and upwards.	At all Ages.
Confluent and Malignant.	54 or 51·9 p.c.	23 or 50·0 p.c.	2 or 50·0 p.c.	79 or 51·3 p.c.
Coherent -	23 „ 22·1 „	12 „ 26·1 „	1 „ 25·0 „	36 „ 23·3 „
Discrete -	19 „ 18·2 „	8 „ 17·4 „	—	27 „ 17·5 „
Mild - -	8 „ 7·7 „	3 „ 6·5 „	1 „ 25·0 „	12 „ 7·7 „
	104	46	4	154

Here we find a rather striking uniformity in the distribution of the types of small-pox at different age-periods, viz., about one-half being confluent (and malignant), one-fourth coherent, one-sixth discrete, and one-twelfth of the mildest type.

Houses invaded by Small-pox.

The following list of the houses invaded by small-pox supplements the information already furnished in the Table of Cases and the particulars of the outbreak. This list has been prepared in part from returns furnished to me of the names and ages of every inmate of an infected house with particulars as to their vaccination; and in part from a personal inspection of the houses which I made at the close of the inquiry, in company with the chief sanitary inspector, Mr. Braley. It will be seen from the brief notes which are appended that the majority of the dwellings inspected were in a good sanitary state, and in but a few was there any over-crowding of the inmates.

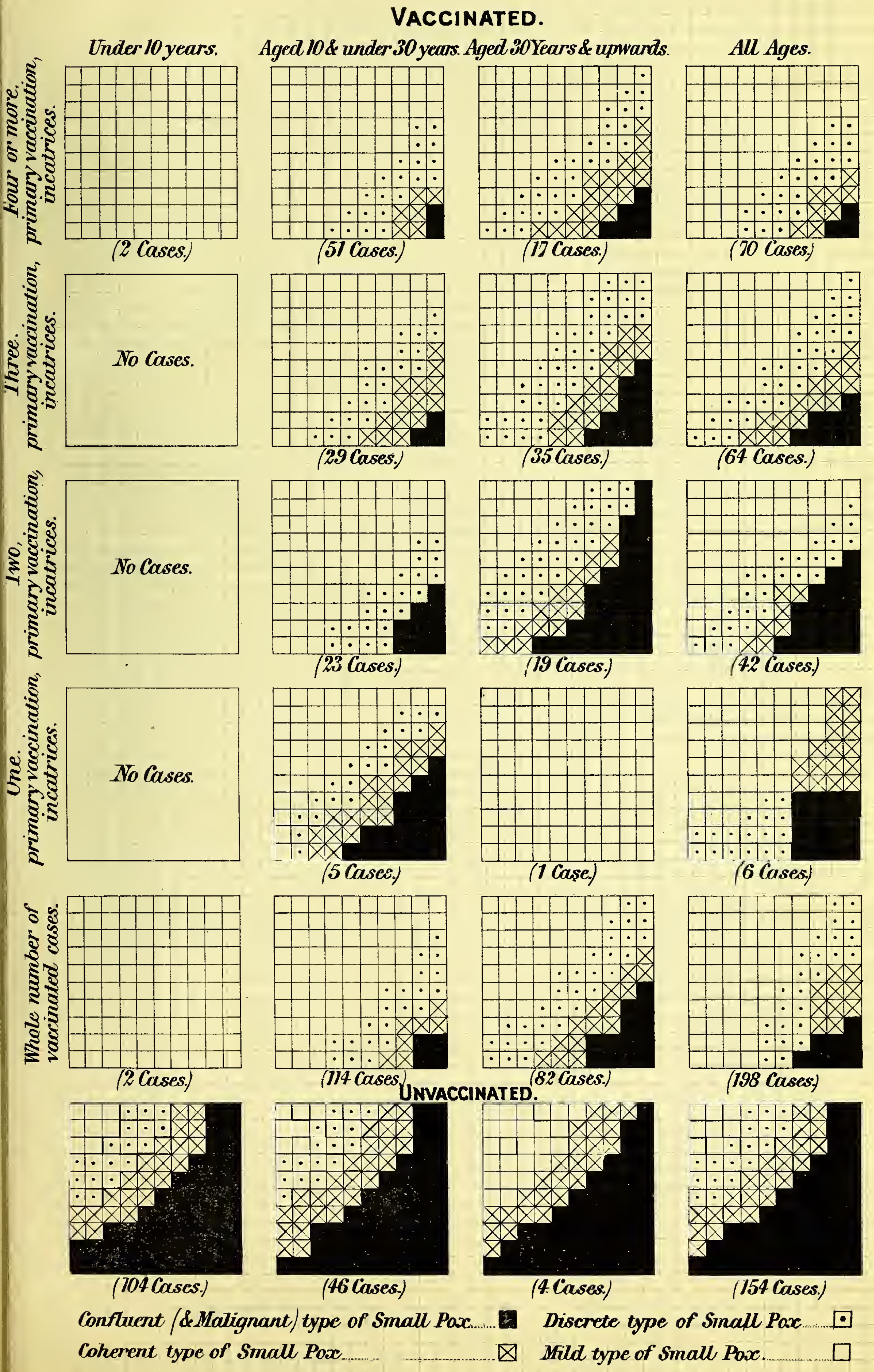
I have taken for purposes of analysis 193 of these households, comprising 1,234 inhabitants; the reason for this selection being the lack of information regarding the five others, Nos. 1, 7, 8, 47, and 71. Moreover three of them were common lodging-houses, the largest of which was No. 7, into which small-pox was introduced on two occasions, the total number of cases occurring in this place being 12. Ten cases were sent from the workhouse, and 11, which arose at the hospital, were retained there and did not return to their homes. Thirty-six cases are thus accounted for, leaving 321 in connexion with the 193 households analysed; but one of these cases was admitted into hospital twice (viz., house No. 36, case 60 (and 111)), having apparently been re-infected.

Thus we have 193 houses with 1,234 inmates, of whom 320 were attacked.

Explanation of Chart VI.:—
This chart shows the proportion of cases of small-pox of different types, at different ages in the vaccinated and unvaccinated respectively.

Chart VIII.

DIAGRAM, *showing the Proportion of Cases, of Small Pox, of different Types which occurred in Vaccinated and Unvaccinated Persons at all and certain Specified Ages.*



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§13. LEICESTER.—SMALL-POX, 1892–3.

LIST of HOUSES INVADED, with DETAILS as to VACCINATION of their INMATES.

Ref. to House List.	Street.	Date of Infection.	Inmates.				Attacked with Small-Pox.*				Persons quarantined at Hospital.	Sanitary Condition of House, &c.
			Vaccinated.	No Information as to Vaccination.	Under Vaccination.	Unvaccinated.	Vaccinated.	No Information as to Vaccination.	Under Vaccination.	Unvaccinated.		
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
1	Workhouse and Britannia Street, Court E.	1892. Aug. 21 -	—	—	—	—	1					Large ill-paved court; open ashpit; pail clean; 2 rooms, old.
2	„ „ -	Sept. 4 -	2				2				6	4 rooms; old house; open ashpit; pail clean.
3	„ Court A.	„ 5 -	1		1	1			5	3	2	Old 2-roomed dwelling; neglected; recent privies.
	Workhouse Infirmary.		—	—	—	—		4				
4	Elm Street - -	„ 28 -	4		2		6		7		5	4 rooms, fairly clean; w.c.; covered ashpit.
5	Crane Street -	Oct. 12 -	3				8				5	4 rooms, clean; new buildings; w.c.; yard to 5 houses.
6	„ „ -	„ 17 -	4			1				9	5	Do. do. do.
7	Lee Street, C. L. H.	„ 18 -	—	—	—	—	10, 19, 62, 78, 109, 112, 132, 141, 142, 144, 145, 151.				1	
	Fever Hospital -	„ 26 -	—	—	—	—	37, 66, 106, 200.			11, **12**, **14**, 15, 16, **21**, 25.		
8	Newport Street -	„ 27 -					13					6 rooms; w.c.; water supply good.
9	Caroline Street -	Nov. 2 -	3				**17**				2	Small house in large well-paved court; pail system; good water supply.
10	Mansfield Street -	„ 3 -	3			1	18				3	Large court to 2 houses; 4 rooms; pail system; open ashpit.
11	Peel Street - -	„ 3 -	4			1				20	6	Large well-paved yard, clean; 4 rooms; pail system; open ashpit.
	Workhouse - -	„ 12 -	—	—	—	—	35, 68, 99, 118, 125, 146, 154.			22		
12	Kent Street. -	„ 13 -	4			3	32			23	10	House not visited.
13	Garfield Street -	„ 14 -	10			1	24				10	Wide well-paved street; 7 rooms in house; clean; water supply good; w.c.
14	Nelson Street -	„ 18 -	5			3				26, 31.	7	Small yard to 2 houses; 4 rooms; pail system; open ashpit.
15	Brookhouse Avenue	„ 19 -	2		1		27					Good house, about 7 rooms; w.c. outside; water supply good.
16	Preston Street -	„ 23 -	5			3				28	7	Yard to 2 houses; 6 rooms; w.c.
17	Stanley Street -	„ 29 -	3		3	1	36			29		House not visited.
18	Milton Street -	Dec. 2 -	7			3				**30**	9	Clean, well kept; 6 rooms; w.c. and urinal in court.
19	Beatrice Road -	„ 10 -	4			2	44			33, 59.	6	6 rooms recently built; good condition; open site.
20	Norfolk Street -	„ 11 -	2			11				34, 77, **114**, 122, 123, 128.		Good; clean; garden at back.
21	Braunstone Gate -	„ 15 -	8			2	38, 67, 94.			53, **61**.		Large house of good class; w.c. within and without; bath room.
22	Baker Street -	„ 15 -	5			2	48			39, 43.	1	Ill-paved street; narrow yard; small house; fair; pail system.
23	Alexandra Street -	„ 20 -	5				40, 51, 52, 92.				4	4 houses in well-paved yard; pail system; open ashpit; house fairly clean.
24	Pool Road - -	„ 23 -	2			2	41, 98.			65, 96.		New 6-roomed house; clean; w.c.; covered ashpit; water supply good.
25	Harrison Street -	„ 30 -	3			1	42				3	6 rooms; clean; paved yard; w.c.; dustbins.
26	Mansfield Street -	„ 31 -	3			6				45, 64, 82, 85, 87.	7	Large yard in front; good buildings; clean; well kept.
27	Western Road -	„ 31 -				4	46					New house; in good sanitary condition.
28	Dryden Street -	„ 31 -	3		1		47, 84					One of 8 houses in yard; 4 rooms; open ash-pit.
29	Western Road -	1893. Jan. 1 -	6				49, 81					One of 7 houses in row; old poor ventilation; pails.
30	Fitzroy Street -	„ 2 -	7	1		2	50					Yard to 4 houses; 4 rooms; pail system; dustbins.
31	Wharf Street -	„ 3 -	5			1				54		New house; shop; good sanitary state.
32	Samuel Street -	„ 3 -	5			3	90, 91			55, 93, 101	3	Yard to 5 houses; 4 rooms; pails, dust bin.
33	Metcalf Street -	„ 4 -	1			3				56, 89		Old street; 5 houses in yard; open ash-pit; ill-kept garden; pails.
34	Baker Street -	„ 4 -	5		3		57				7	As No. 22, but ill-kept.
35	Pasture Lane -	„ 4 -	8				58					Small paved court; neglected; dirty; pails.
36	Abbey Lane - -	„ 5 -	5			1	60 (111)				5	6 rooms; w.c.; clean and sanitary.
37	Bede Street - -	„ 5 -	7				63					New well-kept house.
38	Beatrice Road -	„ 7 -	1			7				69		6 rooms; w.c.; garden; good state.
39	Woodby Street -	„ 8 -	4				70				3	Yard to 6 houses; low built; ill-ventilated.
40	Banford Street -	„ 8 -	3			2				71	9	Not seen.
41	Flint Street - -	„ 9 -	4			3	126			72, 104	5	Yard to 6 houses; ill-drained; w.c.; dustbins.
42	Little Holm Street -	„ 9 -	2	1		4				73	5	New house; good work.
43	Littleton Street -	„ 9 -	7			4	74				10	6 rooms; yard dirty; pails; dustbin.

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* The figures in these columns refer to Table of Cases. Those in leaded type are fatal cases.

TABLE of HOUSES INVADED, with DETAILS as to VACCINATION of their INMATES—*continued.*

Ref. to House List.	Street.	Date of Infection.	Inmates.				Attacked with Small-Pox.*				Persons quarantined at Hospital.	Sanitary Condition of House, &c.
			Vaccinated.	No Information as to Vaccination.	Under Vaccination.	Unvaccinated.	Vaccinated.	No Information as to Vaccination.	Under Vaccination.	Unvaccinated.		
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
44	Bath Street	1893. Jan. 9	8			1	75					Yard not paved; ill-drained; old ill-kept house.
45	Baker Street	„ 9	3			3	76				5	House had been pulled down when place visited.
46	High Cross Street	„ 13	4		1		79					Not visited.
47	Brittania Street, C.L.H,	„ 13	—	—	—	—	80					Lodging-house (52 males); small yard; 3 w.c.'s.
48	Curzon Street	„ 16	3				83					6 rooms; cleanly; well kept; w.c.; dustbin.
49	Heanor Street	„ 17	8			1	86					6 rooms; cleanly; well kept; w.c.; dustbin.
50	Grant Street	„ 17	5			3	119, 124			88	7	Rooms 3; ill-kept.
51	Burgess Street	„ 19	3			1				**95**		4 houses to yard; small and low; w.c.; ash-pit.
52	Metcalf Street	„ 20	3			6				97	8	See No. 33.
53	Argyll Street	„ 22	6			1	100				6	Yard to 4 houses; yard neglected; house fair; pails; open ashpit.
54	Dorset Street	„ 22	2			5	102				6	Yard to 4 houses; w.c.; dustbin; fair.
55	Sanvey Gate	„ 22	2			3	103					Confined court; dirty house; low rooms; pail system; dustbins.
56	Archdeacon Lane	„ 23	1			1				105		Old back-to-back house; ill-kept and dirty; pails.
57	Grundon Street	„ 26	5				107					On riverside; paved yard; pails; open ashpit; fairly kept.
58	Brandon Steeet	„ 27	6				108					6 rooms; good condition.
59	Blackfriars Street	„ 28	2			3	130			**110**	4	Court with several houses; pail system; open ashpit.
60	Salisbury Road	„ 29	18		1		113					Not visited.
61	Alice Street	„ 31	2				115					4 houses to yard; rather dirty; 2 w.c.'s.
62	Brandon Street	„ 31	2		1		116					As No. 28.
63	Pingle Street	Feb. 3	2			3	120				4	Paved yard to 5 houses; garden behind; good.
64	Coventry Street	Jan. 31	6				117					Yard to 2 houses; 9 rooms; fair; w.c.
65	Brandon Terrace	Feb. 4	2		2	3				121, 131		7 rooms; good sanitary state.
66	Curley Street	„ 11	5			1	127				5	Yard to 3 houses; garden plots; pails; open ashpit.
67	Dorset Street	„ 12	2			5	136			129	6	6 rooms; rather dirty; pails; small yard.
68	Gosling Street	„ 18	2			1	143			133		Not seen.
69	Brandon Street	„ 23	3			2	134, 148, 153			147, 152		As No. 58.
70	Buckingham Street	„ 25				5				135, 155	7	Yard to 6 houses; good sanitary state.
71	Britannia Street, C.L.H.	March 1	—	—	—	—	137					Lodging-house; fairly new; small yard; w.c.
72	Moreton Road	„ 1	4			2				138		5 rooms; clean; fairly new; pails.
73	Victoria Avenue	„ 2	9		1		139, 140					Not visited.
74	Bath Street	„ 19	6				149, 156, 161					Large yard and stores; roomy; well kept.
75	Arthur Street	„ 21	10				150					Clean; good sanitary state.
76	Ruby Street	„ 27	3			2	157					Ditto.
77	Martin Street	„ 27	7			1	158, 177			168	5	Yard to 2 houses; clean; good state.
78	Abbey Lane	„ 28	6			1	159					Old buildings; well marked; pails.
79	All Saints' Road	„ 29	3			1	160					Yard to 4 houses; pails; fair.
80	Court D, Burley's Lane.	April 2	2			1	162				1	2 rooms; no back; side of court; pails; open ashpit.
81	Court A, Woodley Street.	„ 3	1			5				163, **185**	5	Court with 10 houses; no backs; pails.
82	Gresham Street	„ 3	2			3	164			183, 197		6 rooms; w.c.; ashpits in yards.
83	Belper Street	„ 4	3		2	2	165, 179		190	173, 174	1	6 rooms; new house; very clean w.c.
84	Hinckley Road	„ 5	8			2	166, 186			**182**, 187		7 rooms; well kept; w.c. in yard.
85	Vernon Road	„ 7	5				167, 169, 170				2	Not seen.
86	Rolleston Street	„ 10	2			4	189			171, 172, 193.		Unpaved yard; pails; 6 rooms; wash-house.
87	Burgrave Street	„ 10	3			2	175, 237			258		Fairly new; well kept; sanitary.
88	Court A., Bath Street	„ 11	2			2	176					Old house; 3 rooms; w.c.; paved court.
89	Cromwell Road	„ 13	2			4				178		Not seen.
90	Knighton Church Road.	„ 14	4			3	180			**194, 198.**		Do.
91	Hazel Street	„ 16	6			3	181					Do.
92	Titchborne Street	„ 17	1			2				184		Large yard to 4 houses; w.c.; dustbin; good drainage.
93	Simpson Street	„ 23	3			2				188		Yard to 5 houses; house fairly clean; pails.
94	Gold Street	„ 25	2			6				191, 209, 218.		Yard to 3 houses; 5 rooms; fair; pails.
95	Granby Avenue	„ 25	8				192, 204					Good; clean; 6 rooms; at back of Burgrave Street.
96	Queen Street	„ 27	1	1		2				195		4 houses to yard; spring water; pails well kept.
97	Victoria Road	„ 28	3			4				196, 222, 223.		Shop; 6 rooms: w.c.

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* The figures in these columns refer to Table of Cases. Those in leaded type are fatal cases.

TABLE of HOUSES INVADED, with DETAILS as to VACCINATION of their INMATES—*continued.*

Ref. to House List.	Street.	Date of Infection.	Inmates.				Attacked with Small-Pox.*				Persons quarantined at Hospital.	Sanitary Condition of House, &c.
			Vaccinated.	No Information as to Vaccination.	Under Vaccination.	Unvaccinated.	Vaccinated.	No Information as to Vaccination.	Under Vaccination.	Unvaccinated.		
1	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
98	Ruby Street - -	1893. April 30 -	5			4	220			199		Clean; garden; wash-house; w.c.
99	Ridley Street -	May 2 -	11			2	201					New built; 6 rooms; w.c.
100	Court D, Burley's Lane.	„ 3 -	3				202					Yard at back full of outbuildings; old; neglected; pails.
101	Mitre and Keys Yard.	„ 5 -	4			1	203					Old, but clean house; small rooms; pails; open ashpit.
102	Mere Road - -	„ 8 -	4			3	205					Good; very clean; on rising ground.
103	Harrison Street -	„ 8 -	3				206					Well kept; 6 rooms; w.c.
104	Sheridan Road -	„ 8 -	5		4		207, 217		219			Not seen.
105	Victoria Road -	„ 10 -	3	1		3				208	6	Yard to 4 houses; ill-kept.
106	Blue Boar Lane -	„ 10 -	4			1	210					Yard to 3 houses; pails; fair.
107	Ashleigh Road -	„ 10 -	3			1				211		Detached house (not visited).
108	Grundon Street -	„ 11 -	3			4				212		Old, but clean; open ditch at back.
109	Abbey Street (L.H.)	„ 11 -	5			3				213, 238	1	Old; low rooms; 5 houses to yard; pails; rooms dirty.
110	Charlotte Street -	„ 11 -	5			2				214		Corner house (inn); fairly well kept.
111	Wand Street -	„ 11 -	2			7				215	8	6 rooms; separate yard; w.c.
112	Emerald Street -	„ 11 -	3			3	240			216		8 houses to yard; street dirty; pails.
113	Moorgate Street -	„ 18 -	7				221, 244, 245, 246, 247, 248.					Well-paved street; house good condition.
114	Mellor Street -	„ 20 -	6			4				224		Separate yard; w.c.; fair state.
115	Hawthorne Street -	„ 20 -	6			2				225		High site; open; w.c.; good condition.
116	Woodgate Terrace -	„ 21 -	3			4				226		12 houses to yard; 2 w.c.'s; fair.
117	High Cross Street -	„ 21 -	10				227					Next door to 131. (House empty at visit.)
118	Cranbourne Street -	„ 24 -	3			3				228		Large gardens to house; w.c.; house clean.
119	Blake Street -	„ 24 -	2				229, 255					Yard to 4 houses; open ashpit; pails; moderate.
120	Leicester Street -	„ 25 -	3			2	230, 253			252, 261		Yard full of pools, &c.; house cleanly.
121	Beatrice Road -	„ 26 -	7				231					About 150 yards from Small-pox Hospital. Clean; good.
122	Gresham Street -	„ 27 -	5			1	272			232		As No. 82 (next door.)
123	Abbey Street -	„ 27 -	5			3				233		Old house; low rooms; dirty (next to 109).
124	Grosvenor Street -	„ 27 -	7			1				234		Butcher's; old house; pails; rooms clean.
125	Denmark Road -	„ 27 -	5				235					Not seen.
126	Wolsey Street -	„ 28 -	7			2				**236**		Yard to 2 houses; w.c.; open ashpit; 6 rooms.
127	Grundon Street -	„ 29 -	2			6				239, 264		Large yard to 4 houses; w.c. and open ashpit at each end; 4 rooms to house; fair.
128	Wright Street -	„ 30 -	7			2	241, 257, 263, 267, 268, 270.			262, 273		10 houses to one passage; garden; 6 rooms; fair.
129	Causeway Lane -	„ 31 -	5				242					2 houses to yard; pails; fair.
130	Burgram Street -	June 1 -	4				243					As No. 87.
131	High Cross Street -	„ 7 -	3			3	249					Baker's shop; cleanly and well kept.
132	Belgrave Gate -	„ 7 -	5			1	250					Butcher's shop; good; clean.
133	Rowan Street -	„ 8 -	1			3				251		Not seen.
134	East Bond Street -	„ 10 -	5			4				254		Greengrocery; new house; shop well kept.
135	Leicester Steeet -	„ 11 -	7			4	256			265		As No. 120.
136	Beatrice Road -	„ 12 -	2		2		259					Very clean; large yard; bakery at back.
137	Syston Street -	„ 12 -	5			1				260		5 rooms; clean; w.c.
138	New Road, Burley's Lane.	„ 13 -	3			1				266		Small old house; dirty; open ashpit; pails.
139	Beatrice Road -	„ 15 -	6				269					Not seen.
140	All Saints' Road -	„ 15 -	7			2	291			271, 289		Neglected; dirty; canal at back.
141	Beatrice Road -	„ 17 -	3			3				274, 282, **288.**		
142	„ „ -	„ 17 -	3				275					As No. 133, &c.
143	Ruby Street -	„ 18 -	3			2	276					
144	Norfolk Street -	„ 19 -	7	1			277					Small villa; 7 rooms; w.c.
145	Ivanhoe Street -	„ 19 -	9				278					6 rooms; well kept; ashpit; w.c. in yard.
146	„ „ -	„ 19 -	2			1				279		As 145.
147	„ „ -	„ 21 -	5				280					
148	Beatrice Road	„ 22 -	2			3				281		As 136, &c.
149	„ „ -	„ 23 -	2			4	345			283		
150	„ „ -	„ 23 -	3		1		284					

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* The figures in these columns refer to Table of Cases. Those in leaded type are fatal cases.

TABLE of HOUSES INVADED, with DETAILS as to VACCINATION of their INMATES—*continued.*

Ref. to House List.	Street.	Date of Infection.	Inmates.				Attacked with Small-Pox.				Persons quarantined at Hospital.	Sanitary Condition of House, &c.
			Vaccinated.	No Information as to Vaccination.	Under Vaccination.	Unvaccinated.	Vaccinated.	No Information as to Vaccination.	Under Vaccination.	Unvaccinated.		
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.
		1893.										
151	Raven Street -	June 23 -	5				285					New house; clean.
152	Thornton Lane -	„ 26 -	5				286					4 rooms; pails in yard, &c.
153	Queen Street -	„ 28 -	9				287					Not seen.
154	Ruby Street -	„ 30 -	3			2				290, 299		As No. 76.
155	Great Holme Street	July 2 -	3				292					Ill-kept; old house; 4 rooms; yard neglected; pails; open ash-pit.
156	Fosse Road - -	„ 4 -	3		7	1				293		Detached house (not visited).
157	Grove Road - -	„ 5 -	3			5				294		Small yard; 6 rooms, to house; fairly kept.
158	Leamington Street -	„ 6 -	2				295					Yard to 2 houses; w.c.; open ash-pit; fair.
159	Brookhouse Street -	„ 6 -	3		1	1				296		Large; well kept; w.c. in house.
160	Newington Street -	„ 8 -	4				297					Separate yard; 6 rooms; clean; w.c.
161	Ivanhoe Street -	„ 9 -	6				298					As 145.
162	Sylvan Street -	„ 22 -	7			1	300					Good sanitary condition; recently built.
163	„ „ -	„ 22 -	3				301					Good sanitary condition; recently built.
164	Newport Street -	„ 25 -	3			2	302			313		As No. 177.
165	Ruby Street - -	„ 25 -	5			1	303					As No. 76.
166	Beatrice Road -	„ 25 -	4				304					Yard at back; open w.c.; 6 rooms and bath-room; well kept.
167	Great Holme Street	„ 26 -	4				305, 310					Builder's yard; clean; sanitary.
168	Beatrice Road -	„ 27 -	6				306					Greengrocery; stabling; w.c.; good.
169	Hinckley Road -	„ 28 -	8				307					Large 12-roomed house; good.
170	Tyndale Street -	„ 31 -	2			1	308					New, and like No. 99.
171	Oban Street - -	Aug. 1 -	4			4				309		6 rooms; well kept.
172	Craven Street -	„ 10 -	1			2	312			**311**		5 cottages in row; no back windows; pails; dustbin; unpaved yard.
173	Castle Street -	„ 12 -	3				314					Not seen.
174	Ruby Street -	„ 13 -	6			3				315, **316**		As No. 76.
175	Dorset Street -	„ 21 -	2			3				317		Passage to 2 houses; yard to each; w.c.; ashpit; fairly kept.
176	Court N, Oxford Street.	„ 26 -	5			2	318, 326, 327.			324, 325		Not seen.
177	Newport Street -	„ 30 -	3		1	1	319			328		Yard; small garden; w.c.; ashpit; new house; fair.
178	„ „ -	„ 31 -	4			1				320		Shop and dwelling; new house; fair.
179	North Bridge Place	Sept. 3 -	4			4				321		Yard to 5 houses (fowls); w.c.; 6 rooms; fair.
180	Dorset Street - -	„ 6 -	2			6	332			322, 329		Yard to 2 houses; fairly clean.
181	Diamond Street -	„ 11 -	8			3	323					Neglected; yard dirty; pail system.
182	New Bridge Street -	„ 20 -	3		1		330					Not seen.
183	Underhill Street -	„ 21 -	3			1				331		6 rooms; w.c.; ashpit; fairly kept.
184	Vann Street - -	Oct. 5 -	7			2	333					Large garden to 8 houses; w.c.; clean.
185	Frog Island - -	„ 6 -	6			3	334			340, 342		New shop; large yard; pails; open ashpit.
186	Grange Lane - -	„ 9 -	5			1	335			338		Large drapery; not seen; sanitary arrangements reported good.
187	Gresham Street -	„ 10 -	3			3	336, 344			341		Yard to 4 houses; long passage; fairly kept.
188	Cheapside - -	„ 14 -	20				337					Not seen.
189	Court D, Archdeacon Lane -	„ 27 -	1			3				**339**		Five rooms; moderate; pails.
190	Catherine Street -	Nov. 16 -	6				343					Not seen.
191	Southampton Street	„ 21 -	6			1	345					6 rooms; well kept; w.c.
192	Beatrice Road -	„ 21 -	2			3				347, 353		As others in road.
193	Ruby Street - -	„ 22 -	5			4	351			**348, 352.**		As No. 98.
194	Clarendon Street -	„ 27 -	7				349					Not seen.
195	Beatrice Road -	„ 30 -	4			1	350			354		As others.
196	Ruby Street - -	Dec. 12 -	4			4				355		As No. 98.
197	Wand Street - -	„ 18 -	5		2	4				356		Well kept; good state.
198	Westbourne Street	„ 20 -	3			1				357		Six rooms; clean and well kept.
	193 households analysed - -		841	5	38	350	170	—	4	146		
							15					Cases in 4 other dwellings (including three lodging-houses).
							4			7		Cases arising at Fever Hospital and not removed.
							8	1		1		Cases arising at Workhouse.
							197 (198*)	1	4	154		* One case twice admitted, 60 (111).

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* The figures in these columns refer to Table of Cases. Those in leaded type are fatal cases.

Note.—Of the 38 here stated to be "under vaccination," 21 were unvaccinated at time of removal of the case. As no further case of small-pox arose in their houses in the subsequent analyses these are included amongst the unvaccinated.

§14. *Analytical Study of the Incidence of Small-pox on the Members of* 193 *infected Households.*

From the particulars kindly furnished to me of all the persons who were removed to quarantine or were under supervision for 15 days after the occurrence of a case of small-pox in a house, I have extracted the details of 193 such infected households.*

The total number of persons dwelling in these houses is 1,234, of whom 320 were attacked with small-pox. The distribution of the cases of small-pox with reference to the size of the households may be gathered from the subjoined table :—

TABLE XXI.

Households.		Total Inmates.	Cases of Small-pox. Number per Household.								Total.
Size (No. of Inmates).	No. infected.		1.	2.	3.	4.	5.	6.	7.	8.	
2	5	10	4	1	—	—	—	—	—	—	6
3	18	54	15	3	—	—	—	—	—	—	21
4	23	92	19	3	—	1	—	—	—	—	29
5	34	170	21	7	3	2	1	—	—	—	57
6	29	174	17	7	4	1	—	—	—	—	47
7	24	168	13	4	4	—	2	1	—	—	49
8	23	184	14	4	4	—	1	—	—	—	39
9	19	171	11	2	4	—	1	—	—	1	40
10	8	80	5	1	—	1	1	—	—	—	16
11	6	66	5	1	—	—	—	—	—	—	7
13	2	26	1	—	—	—	—	1	—	—	7
19	1	19	1	—	—	—	—	—	—	—	1
20	1	20	1	—	—	—	—	—	—	—	1
—	193	1,234	127	33	19	5	6	2	—	1	320

Sex and Age.—Of these 1,234 individuals, 573 were males and 661 females, whilst of the 320 who were attacked with small-pox, 153 were males and 167 females. The rate of incidence was therefore 26·5 per cent. for the male sex and 25·2 per cent. for the female sex.

The age distribution was as follows :—

TABLE XXII.

—	Attacked with Small-pox.	Not attacked.	Total.
Under 1 year - -	7	26	33
1 to 5 years - - - -	31	95	126
5 „ 10 „ - - - -	64	138	202
10 „ 15 „ - - - -	36	135	171
15 „ 20 „ - - - -	33	114	147
20 „ 30 „ - - - -	82	134	216
30 „ 40 „ - - - -	41	94	135
40 „ 50 „ - - - -	19	107	126
50 „ 60 „ - - - -	6	44	50
60 „ 70 „ - - - -	1	14	15
70 and over - - - - -	—	4	4
Age not ascertained - -	—	9	9
	320	914	1,234

These may be distributed between age-periods as follows :—

—	Attacked.	Not attacked.	Total.	Attack Rate.
				Per Cent.
Under 1 year - - -	7	26	33	21·2
1 to 10 years - - -	95	233	328	28·9
10 „ 30 „ - - -	151	383	534	28·2
30 years and upwards -	67	263	330	20·3
Age not ascertained - -	—	9	9	—
	320	914	1,234	25·9

From Table XXI. it will have been seen that in 127 households, comprising 795 individuals, there was only a single case of small-pox; whilst in 66 households, comprising 439 individuals, more than one case occurred (or 193 in all).

Contrasting these two categorics in respect to the ages of the inmates we have :—

Ages of Inmates.	Houses with Single Cases.	Houses with Multiple Cases.
Under 1 year - -	19 or 2·3 per cent.	14 or 3·2 per cent.
1 to 10 years - -	196 „ 24·6 „	132 „ 30· „
10 „ 30 „ - -	358 „ 45·0 „	176 „ 40·1 „
30 years and upwards -	213 „ 26·5 „	117 „ 26·6 „
Age not ascertained -	9 „ 1·2 „	— —
	795	439

These figures show a slight preponderance in the relative number of children in those households in which more than one case of small-pox occurred, as contrasted with those in which only a single case arose.

The difference is still more striking when only those who were attacked are considered.

——	Single.	Multiple.
Under 1 year - -	2 or 1·5 per cent.	5 or 2·5 per cent.
1 to 10 years - -	23 „ 18·1 „	72 „ 37·3 „
10 to 30 „ - -	71 „ 55·9 „	80 „ 41·4 „
30 years and upwards -	31 „ 24·4 „	36 „ 18·6 „
	127	193

It is instructive to note, with reference to the more ready transmission of the disease amongst the young, that a similar preponderance of children attacked with small-pox is to be found in the "multiple series" amongst those who were the first in the household to fall ill. These cases, hereafter termed the "initial" cases, number 80 out of the 193 attacked in those 66 households, and are distributed in age-periods as follows :—

Under 1 year -	-	2 or	2·5 per cent.
1 to 10 years -	-	25 „	31·2 „
10 to 30 years	-	42 „	52·5 „
30 years upwards	-	11 „	13·7 „

If any conclusion is permissible from figures so restricted as those it would be that the liability to further infection of a household on the occurrence of small-pox in one of its members, is greater in proportion to the youth of the subject first to be attacked.

Comparison of those attacked and not attacked as regards Vaccination.

Before proceeding to analyse the facts relating to these households more precisely, it may be well to give here their condition *quâ* vaccination, distinguishing those who were attacked with small-pox and those who escaped infection. The statistics will be found in Tables XXIII. and XXIV., which deal with those houses which yielded single and multiple cases respectively. It will be seen that amongst the unvaccinated, a certain proportion were vaccinated as soon as the case was isolated, *i.e.*, after they had been exposed to chances of infection; and where more than one case occurred 4 out of 17 so vaccinated (and who were therefore under vaccination at the time of exposure or of attack) were attacked by the disease.

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* I have limited this analysis to the persons dwelling in the houses, but it should be stated that sometimes it was found necessary to quarantine others known to have been in contact with the patient but dwelling apart from him.

TABLE XXIII.

SINGLE CASES IN HOUSES (127).

—	Attacked.		Not Attacked.				Total.				
					Unvaccinated.				Unvaccinated.		
	Vaccinated.	Unvaccinated.	Vaccinated.	No information.	Vaccinated on removal of Case.	Remained.	Vaccinated.	No information.	Vaccinated on removal of Case.	Remained.	
Under 1 year	—	2	1	—	—	16	1	—	—	18	19
1-5	—	4	12	—	7	49	12	—	7	53	72
5-10	—	19	50	—	10	45	50	—	10	64	124
10-15	5	8	72	—	2	16	77	—	2	24	103
15-20	10	4	74	—	2	7	84	—	2	11	97
20-30	37	7	112	—	—	2	149	—	—	9	158
30-40	19	—	54	—	—	4	73	—	—	4	77
40-50	7	2	68	4	—	2	75	4	—	4	83
50-60	3	—	37	1	—	—	40	1	—	—	41
60-70	—	—	10	—	—	—	10	—	—	—	10
70 and over	—	—	2	—	—	—	2	—	—	—	2
Age?	—	—	9	—	—	—	9	—	—	—	9
	81	46	501	5	21	141	582	5	21	187	795

TABLE XXIV.

MULTIPLE CASES IN HOUSES (66).

—	Attacked.			Not Attacked.			Total.			
	Vaccinated.	Under Vaccination.	Unvaccinated.	Vaccinated.	Under Vaccination.	Unvaccinated.	Vaccinated.	Under Vaccination.	Unvaccinated.	
Under 1 year	—	1	4	—	1	8	—	2	12	14
1-5	—	1	26	—	2	25	—	3	51	54
5-10	2	1	42	13	4	16	15	5	58	78
10-15	4	—	19	31	4	10	35	4	29	68
15-20	14	1	4	25	2	4	39	3	8	50
20-30	34	—	4	20	—	—	54	—	4	58
30-40	21	—	1	36	—	—	57	—	1	58
40-50	10	—	—	33	—	—	43	—	—	43
50-60	3	—	—	76	—	—	9	—	—	9
60-70	1	—	—	4	—	—	5	—	—	5
70 and over	—	—	—	2	—	—	2	—	—	2
	89	4	100	170	13	63	259	17	163	439
Total in all Houses	170	4	146	671	5 34	204	841	5 38	350	1,234

Influence of Isolation in Limiting Household Infection:—Leaving aside the question of age, the next point of comparison between these two series of infected households to be considered may be to ascertain whether or not the more or less prompt removal to hospital bore any relation to the occurrence of cases after the initial ones had been removed.

Single Cases in Households.

There were 127 houses in which only one case occurred, having a total population of 795, the attack-rate being 16 per cent.

Seven of these cases were treated at their own homes, which contained in all 41 persons, the attack-rate being 17 per cent.

Of the remainder, 120, all of whom were removed to hospital (a case of re-infection was twice admitted, but is not counted twice in this list), came from houses having 754 inmates, the attack-rate being 15·9 per cent.

SINGLE CASES IN HOUSEHOLDS.

A.—LIST of HOUSEHOLDS in which one case of Small-pox occurred and was removed to Hospital.

Reference to House List.	Number of Inmates.	Reference to Case List.	Attacked with Small-Pox.			Remarks.
			Date of Rash.	Date of Removal.	Day of Attack and when Removed.	
2	2	2	Sept. 8	Sept. 9	6th.	
5	3	8	Oct. 17	Oct. 21	10th.	
6	5	9	„ 19	„ 20	4th.	
9	3	17	Nov. 4	Nov. 4	3rd.	
10	4	18	„ 5	„ 5	3rd.	
11	5	20	„ 5	„ 9	7th.	
13	11	24	„ 16	„ 18	5th.	
15	3	27	„ 23	„ 24	6th.	
16	8	28	„ 25	„ 26	4th.	
18	10	30	Dec. 4	Dec. 6	5th.	
25	4	42	„ 26	„ 28	5th.	
27	9	46	Jan. 2	Jan. 3	4th.	
30	10	50	„ 5	„ 7	6th.	
31	6	54	„ 6	„ 8	6th.	
34	8	57	„ 6	„ 8	5th.	
35	8	58	„ 6	„ 13	10th.	
36	6	60	„ 7	„ 8	4th.	
		111	„ 30	„ 30	3rd.	
38	8	69	„ 11	„ 13	7th.	
39	4	70	„ 9	„ 10	3rd.	
40	5	71	„ 10	„ 11	4th.	
42	7	73	„ 10	„ 12	4th.	
43	11	74	„ 12	„ 15	7th.	
45	6	76	„ 11	„ 13	5th.	
48	3	83	„ 18	„ 22	7th.	
49	9	86	„ 19	„ 23	7th.	
52	9	97	„ 21	„ 21	2nd.	
53	7	100	„ 24	„ 25	4th.	
54	7	102	„ 24	„ 25	4th.	
55	5	103	„ 24	„ 25	4th.	
56	2	105	„ 25	„ 26	4th.	
57	5	107	„ 28	„ 28	3rd.	
58	6	108	„ 29	Feb. 1	6th.	
60	19	113	Feb. 1	„ 1	4th.	
61	2	115	„ 2	„ 4	5th.	
62	3	116	„ 2	„ 4	5th.	
63	5	120	„ 6	„ 8	6th.	
64	6	117	„ 2	„ 4	5th.	
66	6	127	„ 13	„ 17	7th.	
72	6	138	March 3	March 6	6th.	
75	10	150	„ 23	„ 23	3rd.	
76	5	157	„ 29	April 3	8th.	
78	7	159	„ 30	„ 1	5th.	
79	4	160	„ 31	March 31	3rd.	
80	3	162	April 4	May 9	38th.	
88	4	176	„ 13	April 14	4th.	
89	6	178	„ 15	„ 16	4th.	
91	9	181	„ 18	„ 19	4th.	
92	3	184	„ 19	„ 21	5th.	
93	5	188	„ 26	„ 28	6th.	
96	4	195	„ 29	May 1	5th.	
99	13	201	May 4	„ 6	5th.	
100	3	202	„ 5	„ 6	4th.	
101	5	203	„ 7	„ 10	6th.	

A.—List of Households, &c.—*continued.*

Reference to House List.	Number of Inmates.	Reference to Case List.	Attacked with Small-Pox.			Remarks.
			Date of Rash.	Date of Removal.	Day of Attack and when Removed.	
102	7	205	May10	May 16	9th.	
103	3	206	„ 10	„ 15	8th.	
105	7	208	„ 12	„ 15	8th.	
106	5	210	„ 12	„ 15	6th.	
107	4	211	„ 12	„ 13	4th.	
108	7	212	„ 13	„ 17	7th.	
110	7	214	„ 13	„ 17	7th.	
111	9	215	„ 13	„ 15	5th.	
114	10	224	„ 22	„ 23	4th.	
115	8	225	„ 22	„ 26	7th.	
116	7	226	„ 23	„ 29	9th.	
117	10	227	„ 23	„ 29	9th.	
118	6	228	„ 26	„ 31	8th.	
121	7	231	„ 28	June 1	7th.	
123	8	233	„ 29	„ 2	7th.	
124	8	234	„ 29	May 31	5th.	
125	5	235	„ 29	June 2	7th.	
126	9	236	„ 30	May 31	4th.	
129	5	242	June 2	June 3	4th.	
130	4	243	„ 3	„ 6	6th.	
131	6	249	„ 9	„ 11	5th.	
132	6	250	„ 9	„ 11	5th.	
133	4	251	„ 10	„ 12	5th.	
134	9	254	„ 12	„ 14	5th.	
136	4	259	„ 14	„ 16	5th.	
137	6	260	„ 14	„ 15	4th.	
138	4	266	„ 15	„ 17	5th.	
139	6	269	„ 17	„ 20	6th.	
142	3	275	„ 20	„ 20	3rd.	
143	5	276	„ 20	„ 21	4th.	
144	8	277	„ 21	„ 25	7th.	
145	9	278	„ 21	„ 23	5th.	
146	3	279	„ 21	„ 23	5th.	
147	5	280	„ 23	„ 25	5th.	
148	5	281	„ 24	„ 25	4th.	
150	4	284	„ 25	„ 27	5th.	
151	5	285	„ 26	„ 30	8th.	
152	5	286	„ 28	July 1	6th.	
153	9	287	„ 30	„ 31	34th.	
155	3	292	July 4	„ 9	8th.	
156	11	293	„ 6	July 9	6th.	
157	8	294	„ 7	„ 11	7th.	
158	2	295	„ 8	„ 10	5th.	
160	4	297	„ 10	„ 11	4th.	
161	6	298	„ 11	„ 12	4th.	
162	8	300	„ 24	„ 26	5th.	
163	3	301	„ 24	„ 27	6th.	
165	6	303	„ 27	Aug. 4	11th.	
166	4	304	„ 27	July 29	5th.	
168	6	306	„ 29	„ 30	4th.	
170	3	308	Aug. 2	Aug. 9	10th.	
171	8	309	„ 3	„ 4	4th.	
175	5	317	„ 23	„ 24	4th.	
178	5	320	Sept. 2	Sept. 3	4th.	
179	8	321	„ 5	„ 6	4th.	
181	11	323	„ 13	„ 14	4th.	

A.—List of Households, &c.—*continued.*

Reference to House List.	Number of Inmates.	Reference to Case List.	Attacked with Small-pox.			Remarks.
			Date of Rash.	Date of Renewal.	Day of Attack and when Removed.	
182	4	330	Sept. 22	Sept. 24	5th.	
183	4	331	„ 23	„ 26	6th.	
184	9	333	Oct. 7	Oct. 9	5th.	
188	20	337	„ 16	„ 18	5th.	
189	4	339	„ 29	„ 30	4th.	
190	6	343	Nov. 18	Nov. 21	6th.	
191	7	346	„ 23	„ 24	4th.	
194	7	349	„ 29	„ 30	4th.	
196	8	355	Dec. 14	Dec. 16	4th.	
197	11	356	„ 20	„ 26	9th.	
198	4	357	„ 22	„ 24	5th.	

B.—Households in which the Case of Small-pox Remained at Home.

Reference to House List.	Number of Inmates.	Reference to Case List.	Attacked with Small-pox.			Remarks.
			Date of Onset.	Date of Rash.	Day of Attack and when Removed.	
37	7	63	Jan. 5	?		
44	9	75	„ 9	?		
46	5	79	„ 12	?		
51	4	95	„ 19	?		
159	5	296	July 6	?		
169	8	307	„ 28	July 30.		
173	3	314	Aug.			

Multiple Cases in Households.

More than one case of small-pox occurred in 66 of the households under review, which contained a population of 439 individuals, of whom 193 were attacked with the disease, a rate of nearly 44 per cent.

In considering these cases it is important to distinguish between those who were first to be attacked and those who sickened subsequently. The former are here styled "initial" cases, the rest being termed "later cases." Occasionally it happened that two or more of the inmates fell ill within a few days of one another, being probably infected from the same source, and in that case they would all be regarded as "initial" cases, to which, perhaps, no later ones succeeded. In that case the households concerned would really fall into the same category as those in which only one case occurred, and in dealing with them statistically it will be necessary to transfer them to that category. I have therefore only placed in the category of "later" cases, who may possibly have received infection from the "initial" ones in the same house, those whose illness began on the 12th, or subsequent days of the onset of the initial case. I do not intend to imply that in every case the infection was traceable to the previous one, for this is beyond proof. It is highly probable that this was so in the majority of instances.

Thus, of the 193 cases, 80 may be regarded as being "initial," and 113 as belonging to the group of "later" (and possibly secondary) cases.

As showing the influence of hospital isolation in limiting the spread of the disease in a family, these multiple cases may be divided into two groups, viz.:—

Series A. in which the initial case was removed to hospital, and

Series B., in which the initial cases remained at home.

Series A. comprises 51 households, containing 338 members, of whom 140 were attacked with small-pox; 64 of these may be regarded as "initial" cases, or 19·8 per cent. of all exposed. Subtracting them we have 274 persons, of whom 76, or 27·7 per cent., were subsequently attacked.

Series B. includes 15 households, containing 101 members, of whom 53 were attacked with small-pox; 16 of these may be regarded as "initial" cases, or 15·8 per cent. of the whole number. Subtracting them we have 85 persons, of whom 37, or 43·5 per cent., were subsequently attacked.

According to this the influence of hospital isolation in limiting the spread of the disease in families may be represented as the difference between 27·7 per cent. and 43·5 per cent. of those remaining after the first invasion of the disease in the household.

This, however, requires correction, since in six of these households (Nos. 73, 85, 104, 135, 172, 174) in Series A., the cases were probably infected from a same source, and it cannot be said that any was secondary to a previous case in the house. By eliminating these households comprising 27 individuals, of whom 14 were attacked, the numbers in Series A. were reduced to 45 households, 291 inmates, 50 being attacked in the first instance, and of the 241 remaining 76, or 31·1 per cent., subsequently sickened.

The influence of hospital isolation may then be more correctly stated as between 31·1 per cent. and 43 per cent.

MULTIPLE CASES IN HOUSEHOLDS.

SERIES A.—INITIAL CASES REMOVED TO HOSPITAL.

Ref. to House List.	Number of Inmates.	Initial Cases.				Later Cases.				Remarks.
		Ref. to Case List.	Date of Onset.	Date of Rash.	Day of Removal.	Ref. to Case List.	Date of Onset.	Day of Attack of Initial Case.	Date of Removal.	
3	3	3	Sept. 5	Sept. 7	6th	5	Sept. 27	23rd		
4	6	6	Sept. 28	Oct. 3	6th	7	Oct. 13	16th	Oct. 19	
12	7	23	Nov. 13	Nov. 16	7th	32	Dec. 7	26th	Dec. 10	
14	8	26	Nov. 18	Nov. 21	6th	31	Dec. 4	17th	Dec. 6	
17	7	29	Nov. 29	Dec. 1 -	5th	36	Dec. 12	14th	Dec. 17	
28	4	47	Dec. 31	Jan. 3	6th	84	Jan. 17	18th	Jan. 19	
29	6	49	Jan. 1	Jan. 5	8th	81	Jan. 15	15th	Jan. 18	
33	4	56	Jan. 4	Jan. 6	4th	89	Jan. 18	15th	Jan. 20	
59	5	110	Jan. 28	Jan. 31	7th	130	Feb. 16	20th	Feb. 18	
65	7	121	Feb. 4	Feb. 7	8th	131	Feb. 16	13th	Feb. 18	
67	7	129	Feb. 12	Feb. 14	5th	136	Feb. 27	16th	March 2	
68	3	133	Feb. 18	Feb. 21	6th	143	March 7	18th	March 10	
70	5	135	Feb. 25	Feb. 27	3rd	155	March 26	20th	March 29	
73	10	139 140	March 2 „ 3	March 6 „ 6	5th 4th					
81	6	163	April 3	April 5	7th	185	April 19	17th	April 22	
98	9	199	April 30	May 2	4th	220	May 17	18th	May 20	
109	8	213	May 11	May 13	6th	238	May 29	19th	June 2	
112	6	216	May 11	May 13	6th	240	May 30	20th	June 2	
122	6	232	May 27	May 29	5th	272	June 16	21st	June 19	
127	8	239	May 29	May 31	4th	264	June 13	16th	June 17	
135	11	256 265	June 11 „ 13	June 13 „ 15	3rd 4th					
149	6	283	June 23	June 25	5th	345	Nov. 20	—	Nov. 23	No doubt fresh infection
154	5	290	June 30	July 2	40th	299	July 14	15th	Aug. 8	
164	5	302	July 25	July 27	9th	313	Aug. 12	19th	Aug. 15	
167	4	305	July 26	July 28	6th	310	Aug. 9	15th	Aug. 13	
172	3	311 312	Aug. 10 „ 10	Aug. 12 „ 12	5th 5th					
174	9	315 316	Aug. 13 „ 16	Aug. 15 „ 18	5th 4th					
177	5	319	Aug. 30	Sept. 1	7th	328	Sept. 18	20th	Sept. 21	
192	5	347	Nov. 21	Nov. 23	4th	353	Dec. 6 -	16th	Dec. 8 -	

Series A.—Initial Cases removed to Hospital—*continued.*

Ref. to House List.	Number of Inmates.	Later Cases.				Initial Cases.				Remarks.
		Ref. to Case List.	Date of Onset.	Date of Rash.	Day of Removal.	Ref. to Case List.	Date of Onset.	Day of Attack of Initial Case.	Date of Removal.	
195	5	350	Nov. 30	Dec. 2	4th	354	Dec. 12	13th	Dec. 14	
19	6	33	Dec. 10	Dec. 16	12th	44	Dec. 31	22nd	Jan. 2	
						59	Jan. 4	26th	„ 6	
41	7	72	Jan. 9	Jan. 11	23rd	104	Jan. 23	15th	Jan. 28	
						126	Feb. 9	32nd	Feb. 11	
50	8	88	Jan. 17	Jan. 19	8th	119	Feb. 2	15th	Feb. 4	
						124	„ 4	17th	„ 6	
77	8	158	March 27	March 29	22nd	165	April 8	13th	April 12	
						177	„ 12	17th	„ 15	
85	5	167	April 7	April 9	7th					
		169	„ 10	„ 12	4th					
		170	„ 10	„ 12	6th					
90	7	180	April 14	April 16	6th	194	April 26	13th	April 29	
						198	„ 30	17th	May 2	
94	8	191	April 25	April 27	3rd	209	May 10	16th	May 12	
						218	„ 13	19th	„ 15	
97	7	196	April 28	May 1	12th	222	May 19	22nd	May 22	
						223	„ 19	22nd	„ 22	
104	9	207	May 8	May 10	4th					
		217	„ 13	„ 16	4th					
		219	„ 17	„ 20	4th					
140	9	271	June 15	June 17	5th	289	June 29	15th	July 2	
						291	July 2	18th	„ 4	
141	6	274	June 17	June 19	4th	282	June 22	16th	June 24	
						288	„ 29	23rd	July 2	
180	8	322	Sept. 6	Sept. 8	6th	329	Sept. 20	15th	Sept. 22	
						332	„ 21	16th	„ 24	
23	5	40	Dec. 20	Dec. 22	5th	51	Jan. 3	15th	Jan. 5	
						52	„ 3	15th	„ 8	
						92	„ 19	31st	„ 22	
86	6	171	April 10	April 12	7th	189	April 23	14th	April 27	
		172	„ 10	„ 12	7th	193	„ 26	17th	May 2	
120	5	230	May 25	May 27	7th	252	June 8	15th	June 12	
						253	„ 9	16th	„ 12	
						261	„ 12	19th	„ 14	
26	9	45	Dec. 31	Jan. 2	13th	82	Jan. 16	17th	Jan. 18	
		64	Jan. 6	„ 9	7th	85	„ 17	18th	„ 20	
						87	„ 17	18th	„ 19	
32	8	55	Jan. 3	Jan. 5	21st	90	Jan. 18	16th	Jan. 23	
						91	„ 18	16th	„ 23	
						93	„ 19	17th	„ 23	
						101	„ 22	20th	„ 24	
83	7	165	April 4	?	—	190	April 24	21st	April 28	
		173	„ 10	April 12	5th					
		174	„ 10	„ 12	5th					
		179	„ 14	„ 16	4th					

SERIES A.—INITIAL CASES REMOVED TO HOSPITAL—*continued.*

Ref. to House List.	Number of Inmates.	Initial Cases.				Later Cases.				Remarks.
		Ref. to Case List.	Date of Onset.	Date of Rash.	Day of Removal.	Ref. to Case List.	Date of Onset.	Day of Attack of Initial Case.	Date of Removal.	
176	7	318	Aug. 26	Aug. 28	8th	324	Sept. 11	17th	Sept. 14	
						325	„ 11	17th	„ 13	
						326	„ 11	17th	„ 13	
						327	„ 12	18th	„ 14	
20	13	34	Dec. 11	Dec. 13	7th	77	Jan. 10	31st	—	
						114	„ 30	51st	Feb. 4	
						122	Feb. 4	56th	„ 7	
						123	„ 4	56th	„ 7	
						128	„ 12	54th	„ 16	
113	7	221	May 18	May 20	9th	244	June 1	15th	June 6	
						245	„ 2	16th	—	
						246	„ 4	18th	June 6	
						247	„ 4	18th	„ 9	
						248	„ 4	18th	—	

MULTIPLE CASES IN HOUSEHOLDS.

SERIES B.—INITIAL CASES REMAINED AT HOME.

Reference to House List.	Number of Inmates.	Initial Cases.			Later Cases.				Remarks.
		Reference to Case List.	Date of Onset.	Date of Rash.	Reference to Case List.	Date of Onset.	Day of Attack of Initial Case.	Date of Removal to Hospital.	
119	2	229	May 24	?	255	June 10	18th	June 17	
186	6	335	Oct. 9	Oct. 11	338	Oct. 20	12th	Nov. 3	
22	7	39	Dec. 15	Dec. 15	43	Dec. 30	16th	Jan. 2	
					48	Jan. 1	18th	„ 5	
74	6	149	March 19	?	161	April 2	15th	—	Nos. 149 and 156 were not notified.
		156	„ 26						
82	5	164	April 3	April 3	183	April 17	15th	April 20	
					197	„ 29	27th	May 2	
87	5	175	April 10	?	237	May 23	49th	June 1	No. 175 was not notified.
					258	June 11	63rd	„ 13	
185	9	334	Oct. 6	Oct. 8	340	Oct. 28	23rd	Nov. 1	
					342	Nov. 13	39th	„ 16	
187	6	336	Oct. 10	Oct. 12	341	Nov. 2	24th	Nov. 6	
					344	„ 20	42nd	„ 23	
193	9	348	Nov. 22	Nov. 24	351	Dec. 3	12th	Dec. 5	
					352	„ 3	12th	„ 5	
84	10	166	April 5	April 7	182	April 16	12th	April 22	
					186	„ 19	15th	„ 24	
					187	„ 20	16th	„ 22	
21	1	38	Dec. 15	Dec. 17	53	Jan. 3	20th	Jan. 11	
					61	„ 5	22nd	„ 10	
					67	„ 7	24th	„ 11	
					94	„ 19	36th	„ 21	
69	5	134	Feb. 21	Feb. 23	147	March 11	19th	—	These cases were not notified.
					148	„ 13	21st		
					152	„ 22	30th		
					153	„ 22	30th		

SERIES B.—INITIAL CASES REMAINED AT HOME—*continued.*

Reference to House List.	Number of Inmates.	Initial Cases.			Later Cases.				Remarks.
		Reference to Case List.	Date of Onset.	Date of Rash.	Reference to Case List.	Date of Onset.	Day of Attack of Initial Case.	Date of Removal to Hospital.	
95	8	192	April 25 -	?	204	May 6 -	12th	June 3 -	No. 192 not notified.
24	4	41	Dec. 23 -	?	65	Jan. 6 -	15th	Jan. 25 -	No. 41 convalescent from a mild and unrecognised attack of small-pox, was removed to hospital with her children on Jan. 25.
					96	„ 20 -	29th	„ 25 -	
					98	„ 20 -	29th	„ 25 -	
128	9	241	May 30 -	?	257	June 11 -	13th	June 15 -	No. 241 not notified.
					262	„ 13 -	15th	„ 16 -	
					263	„ 13 -	15th	„ 19 -	
					267	„ 14 -	16th	„ 19 -	
					268	„ 14 -	16th	„ 19 -	
					270	„ 15 -	17th	„ 19 -	
					273	„ 17 -	19th	„ 19 -	

TABLE SHOWING THE DAY OF ATTACK UPON WHICH SMALL-POX WERE REMOVED TO HOSPITAL.

—	Group I.	Group II.	
	No. of Cases.	(Initial Cases.) No. of Cases.	Later Cases.
Removed on 2nd day -	1	—	—
„ 3rd „ -	8	2	28
„ 4th „ -	40	7	24
„ 5th „ -	36	8	8
„ 6th „ -	18	10	9
„ 7th „ -	15	9	2
„ 8th „ -	6	4	—
„ 9th „ -	4	2	—
„ 10th „ -	3	—	—
„ 11th „ -	1	—	—
„ 12th „ -	—	2	—
„ 13th „ -	—	1	—
„ 21st „ -	—	1	—
„ 22nd „ -	—	1	—
„ 23rd „ -	—	1	—
„ 26th „ - „ 34th „ -	1	—	1
„ 38th „ - „ 40th „ -	1	1	—
	134	49*	72†

* One of the initial cases in Group II., Series A., was not removed to hospital (No. 165). Three other inmates of the house sickened within six to ten days of the onset of this patient's illness, and are here returned as being also "initial" cases; they were removed to hospital.

† Four cases not removed, Nos. 3, 77, 245, 248.

The reason for the late removal of cases—practically convalescent—lies in the fact that attention was generally not drawn to them until the occurrence of subsequent cases, as the following will show :—

Group I., No. 287.—S. M., f., æt. 47., admitted on July 31st, the 34th day of her illness, which was unaccompanied by any marked constitutional disturbance; but two days after its commencement she was attacked by a profuse eruption, which was still well marked when admitted. There was no history of contact with a previous case; and the course and character of the rash was so anomalous that it was very doubtfully regarded as variolous. She was not put into the small-pox ward. She was said to have been re-vaccinated in 1871.

No. 162.—J. H., m., æt. 39, admitted on May 9th, the 38th day of his illness, presenting characteristic scabs of variola pustules. He had not been attended by a medical man; but a fortnight after he was taken ill his child sickened, and died on April 23rd, the cause of death being certified as "convulsions."

Group II., No. 33.—W. G. S., æt. 13, unvaccinated, a confluent attack, but not seen by medical officer until maturation was setting in. He at once removed the child to hospital, the 12th day of his illness. Two other cases arose in this house, viz., No. 44, who sickened on the 22nd day of the invasion in the first case, and was therefore probably infected about four days before No. 33's removal, and No. 59 who sickened four days later, and who may have been infected the same day that No. 33 was removed.

No. 196, B. S., f., æt. 2, unvaccinated, admitted May 9th, the 12th day of illness, having contracted the disease apparently from her father, who lives at T——, a village near Leicester. The child when taken ill was sent to its grandmother's in Leicester, where the case was discovered. Two other children subsequently sickened, Nos. 222 and 223, both on the 22nd day of the illness of No. 196, and were therefore probably infected four days before her removal to hospital.

No. 45, N. H., f., æt. 12, unvaccinated, had a very mild attack, the eruption fading when she was admitted on the 13th day of her illness. Six days after her illness began, her sister, F. H., æt. 14 (No. 64), sickened, and was taken into hospital the same day as No. 45, viz., January 12th, her attack being a severe and unmistakeable one. Three other children of this family subsequently sickened (viz., Nos. 82, 85, 87), three and four days after the removal of No. 45, by whom they had probably been infected about the 4th or 5th day of her illness.

No. 55, F. J., m., æt. 10, unvaccinated, had a discrete attack, which passed unrecognised until other cases arose in the house. He was admitted on the 21st day of attack, the four others (90, 91, 93, and 101) all falling ill within this period of his illness.

No. 158, H. B., f., æt. 21, vaccinated, was another case which had passed unrecognised, and was not discovered until inquiries were being made about a series of persons who had also mostly had mild unrecognised attacks. No. 158 had recovered from the eruption which had been sparsely distributed over the face and arms, when admitted on the 22nd day.

No. 72, J. J. J., m., æt. 8, unvaccinated, was taken into quarantine when his sister C. J. (No. 104) was admitted into the small-pox ward. It then became evident from the stains and marks on his limbs and face that he had recently passed through an attack himself, and was probably the source of the infection of No. 104 and No. 126.

No. 290, E. C., f., æt. 8 months, unvaccinated, passed through a severe attack without having any medical attendance, and about 14 days after she was attacked her brother, W. A. C., æt. 3, unvaccinated (No. 299), also sickened and had a confluent attack. Although neither was admitted until late in the disease, No. 299 on the 26th day, and No. 290 on the 40th day (both showing marked pitting and traces of eruption), no other members of the household suffered. They were only three in number, aged 5, 30, and 34 years respectively, and were all vaccinated.

To the foregoing 10 cases of unavoidable delay in admission to hospital may be added the following cases of mild small-pox which were not under medical treatment, and were detected by the sanitary authority.

In Group I., No. 303 was discovered in a house-to-house inspection of the district, a week after the rash appeared. She was removed to hospital on the 11th day.

No. 58 was also first seen after the rash had been out for a week, and was removed on the 10th day.

No. 227 admitted on 9th day.

No. 205 admitted on 9th day.

No. 292 discovered at home, not having medical advice; was admitted on the 8th day.

In Group II., No. 221, a dressmaker, who may have been infected through a visit of a nurse at the small-pox hospital, was admitted on the 9th day, and five other members of the family infected during the first days of her illness, also had sparse eruptions.

Deducting these 16 cases there remain for comparison in Group I., 127 cases; in Group II., 41 initial and 71 later cases.

In Group I., 85, or 67 per cent., were removed on the 5th day or earlier.

In Group I., 42, or 33 per cent., were removed on the 6th to 10th day.

In Group II., initial cases, 17, or 41·4 per cent., on 5th day or earlier.

In Group II., initial cases, 24, or 58·5 per cent., 6th to 9th day.

In Group II., later cases, 60, or 84·5 per cent., on 5th day or earlier.

In Group II., later cases, 11, or 15·5 per cent., on 6th and 7th days.

This computation clearly shows, as might have been anticipated, that promptitude in hospital isolation is a potent safeguard to the remaining members of a family. For Group I. is composed of households in which no cases were traceable to infection from the first to be attacked; while two-thirds of the cases were removed by the 5th day of attack; whereas in Group II., households in which cases arose subsequent to and probably infected by the first cases, only two-fifths of these initial cases were removed by the 5th day. It also shows how large a proportion can be removed in these early days when the invaded households are under observation, more than four-fifths of the later cases in this group being thus early isolated.

Quarantine of Members of Infected Households.

Dealing with the 193 households which have been here analysed, it is found that from 45 of them, containing in all 314 individuals, there were sent into quarantine at the hospital when the case (or cases) of small-pox was removed—211 of the unaffected inmates together with 24 other persons known to have been in contact with the patient. Of this number (211) 15 or 7·1 per cent. were attacked during the period of quarantine, whilst 4 others or 1·9 per cent. developed small-pox from 6 to 12 days after returning to their homes, the inference being that they must have been infected whilst in quarantine.

The system of quarantining was in operation from the beginning of the outbreak until May.

	Total of Invaded Houses.	Houses whence Inmates sent to Quarantine.	Households from which Members sent to Quarantine.						Total Number in Households sent to Quarantine.	Total Inmates of all Invaded Houses.
			Initial Cases of Small-pox.	Sent to Quarantine.	Later Cases of Small-pox.			Remained at Home.		
					Arising before Quarantine.	During Quarantine.	After Quarantine.			
September 1892 -	3	3	3	8	—	1	1	—	11	11
October ,, -	2	2	2	6	—	—	—	—	8	8
November ,, -	9	7	7	38	—	1	1	—	45	56
December ,, -	11	6	7	29	2	7	1	5	43	81
January 1893 -	34	14	14	78	5	4	—	6	103	225
February ,, -	7	4	4	19	—	1	1	—	23	38
March ,, -	8	1	1	5	2	—	—	2	10	56
April ,, -	19	4	9	9	1	1	—	3	22	117
May ,, -	31	4	4	19	1	—	—	6	30	213
	124	45	51	11	11	15	4	22	295	805

It is apparent from these figures that the system of removal to quarantine of those dwelling in infected houses was only partially carried out during the months it was in operation. The alternative method, that, namely, of keeping infected households and persons known to have been exposed to infection under supervision by the sanitary officials for the quarantine period, was carried out in the remainder, and in all those which occurred after the month of May. It is impossible to secure data which would enable me to judge of the comparative efficiency of these two systems. In theory, the isolation of an infected family for 15 days should prevent the spread of the disease beyond its limits: and it might be thought that this isolation was far more certainly secured by removal of the family to a special quarantine building. On the other hand, when, as was the case at Leicester, the quarantine building is contiguous to that used for the reception of those attacked with the disease, there must be some risk of infection of those quarantined, or of their transference of contagion to others on leaving quarantine. These considerations, besides the fact that both plans were in operation together, make it very difficult to institute a comparison between them.

	Houses: Number Invaded.	Number of Inmates.	Attacked with Small-pox.		Sent to Quarantine.	Remained at Home.
			Initial Cases.	Later Cases.		
September 1892 - - -	3	11	3	2	8	—
October ,, - - -	2	8	2	—	6	—
November ,, - - -	9	56	9	3	38	8
December ,, - - -	11	81	12	23	29	40
January 1893 - -	34	225	34	11	78	113
February ,, - - -	7	38	7	8	19	12
March ,, - - -	8	56	10	3	5	41
April ,, - - -	19	117	25	19	9	83
May ,, - - -	31	213	33	20	19	161
June ,, - - -	25	147	26	6	—	121
July ,, - - -	16	86	16	2	—	70
August ,, - - -	8	45	10	5	—	35
September ,, - - -	5	35	5	2	—	30
October ,, - - -	6	54	6	5	—	48
November ,, - - -	6	39	6	4	—	33
December ,, - - -	3	23	3	—	—	20
	193	1,234	207	113	211	815

So far as the information at my disposal goes I have reasonable ground for the belief that in 19 groups containing in all 52 houses, there was infection from house to house. In 12 of these groups only two houses are concerned, viz.: Nos. 19 and 38; 20 and 70; 21 and 37; 22 and 34; 25 and 36; 32 and 41; 90 and 104; 108 and 127; 109 and 123; 113 and 132; 117 and 131; 176 and 183. The total number of inmates of these 24 houses amounted to 176, of whom 54 were attacked with small-pox, 39 of the cases arising in the 12 houses first invaded and 15 in the 12 invaded secondarily. Again, of this group, the inmates of five houses first to be attacked (Nos. 19, 22, 25, 32, and 109) were quarantined at the hospital, the number of cases of small-pox in these houses amounting to 15, whilst 7 cases occurred in the five houses secondarily invaded, the inmates of three of which were removed to quarantine.

In three groups there were three houses invaded, viz.: Nos. 5, 6, and 10; 80, 94, and 100; 97, 105, and 114. The inmates of these nine houses numbered 50, of whom 13 were attacked with small-pox, five in the houses first invaded, and eight in those invaded secondarily. Of these groups, the inmates of two houses first infected (Nos. 5 and 80) were removed to quarantine at the hospital, there being only one case in each house, and six in the four others secondarily invaded, the inmates of two of which were also removed to quarantine.

In two groups there were four houses, invaded, viz: Nos. 35, 49, 53, and 54; 84, 99, 101, and 106. The inmates of these eight houses amounted to 64, of whom 17 were attacked with small-pox, five arising in the two houses first invaded, and 12 in the six others. In neither instance were the inmates of the house first invaded removed to quarantine, but those of three of the secondarily invaded houses were so dealt with.

There is one group of five invaded houses, viz.: Nos. 87, 95, 120, 130, and 135, numbering 33 inmates, of whom 12 were attacked with small-pox and none removed to quarantine; three of the cases arose in the first house.

There is also one group of six such invaded houses, viz.: Nos. 69, 74, 77, 82, 83, and 86, comprising 36 inmates, of whom 22 were attacked with small-pox, five cases arising in the first invaded house. The members of two of the secondarily infected houses were removed to quarantine at the hospital.

Thus inmates of seven houses were removed to quarantine on the occurrence of small-pox in the house, but not until 9 other families had been more or less directly infected by them. The total number of inmates of these houses was 96, of whom 30 were attacked with small-pox, 17 of those cases occurring in the seven households first invaded.

Per contra, the inmates of 12 invaded households remained at home, and 24 other families were more or less directly infected by them. The total number of inmates of these houses was 263, of whom 88 were attacked with small-pox, 42 of these cases arising in the 12 houses first invaded.

In order to attempt a just comparison it will be necessary to subtract from the latter all those households in which cases occurred unknown to the authorities, until, perhaps, on making inquiry into the origin of other cases those were revealed.

In the case of those households primarily infected, whose members were removed to quarantine at the same time as the case of small-pox was removed to hospital, it will be seen from the subjoined analysis, that such removal took place at periods varying from 4 to 37 days subsequent to the first appearance of small-pox in the house, and that in only two instances, viz., in one where such removal occurred on the 10th day, the other where it occurred on the 38th day, was more than one other household secondarily infected.

In the case of those households primarily infected, whose members were not removed to quarantine, it will be observed that in one instance, where five persons were attacked in the house, not one of which was notified—there were five other houses secondarily infected. In three other instances—the first case arising in the primarily infected houses was not removed (owing to non-notification) and the fact of such houses being infected was not known to the authorities until periods ranging from 17 to 52 days after the first appearance of small-pox in the house. It is not surprising therefore to find that eight other households were infected from these. However, it appears that in one instance (No. 21) small-pox appeared in the house secondarily infected after the removal of two of the cases in the first house; in another (No. 84), after all the cases had been removed from the first house, small-pox appeared in the three houses secondarily infected; and in the third (No. 87) no case had been removed from the first house before the disease made its appearance in the four other houses secondarily attacked, of the remainder, 8 houses, the cases first arising were removed to hospital at periods ranging from 5 to 11 days after the onset of symptoms. There were 11 households secondarily infected from them, 5 of which were in connexion with those in which removal took place on the 10th and 12th days of attack respectively. In each of these instances the first case arising had been removed prior to the appearance of small-pox in other households.

House-to-House Infection.

Reference.	Households Primarily infected.			Households Secondarily infected.	
	Day of Attack of Initial Case on which Quarantine established.	Number of Cases arising—		Number.	Cases therein.
		Before Quarantine.	During Quarantine.		
No. 25	5th day	1	—	1	1
" 109	6th "	1	1	1	1
" 5	10th "	1	—	2	2
" 19	12th "	1	2	1	1
" 22	16th "	2	1	1	1
" 32	24th "	6	—	1	3
" 80	38th "	1	—	2	4
7 houses.		13	4	9 houses.	13

Reference.	Households primarily infected.		Of other Cases	Houses secondarily infected.	
	Number of Cases in Household.	Day of Removal of First Case.		Number.	Cases therein.
No. 90	3	6th day	16th and 19th	1	3
" 20	6	7th "	51st to 56th (one not removed).	1	2
" 108	1	7th "	—	1	2
" 176	5	8th "	19th and 20th	1	1
" 113	6	9th "	20th and 23rd (two not removed).	1	1
" 117	1	9th "	—	1	1
" 35	1	10th "	—	3	3
" 97	3	12th "	25th	2	2
" 84	4	Not removed	18th and 20th	3	3
" 21	5	"	28th to 30th	1	1
" 87	3	"	53rd and 65th	4	9
" 69	5	"	Not removed.	5	17
12 houses.	43			24	45

The removal to quarantine, which coincided with the removal of the case of small-pox (in a few instances this was not the first case arising in the house), took place at the following periods of the invasion of the household by the disease:—

In 1 house, family removed to quarantine on 2nd day.
,, 4 ,, ,, ,, ,, 3rd ,,
,, 7 ,, ,, ,, ,, 4th ,,
,, 9 ,, ,, ,, ,, 5th ,,
,, 7 ,, ,, ,, ,, 6th ,,
,, 7 ,, ,, ,, ,, 7th ,,
,, 2 ,, ,, ,, ,, 8th ,,
,, 1 ,, ,, ,, ,, 10th ,,
,, 1 ,, ,, ,, ,, 12th ,,
,, 1 ,, ,, ,, ,, 13th ,,
,, 1 ,, ,, ,, ,, 19th ,,
,, 1 ,, ,, ,, ,, 21st ,,
,, 1 ,, ,, ,, ,, 22nd ,,
,, 1 ,, ,, ,, ,, 23rd ,,
,, 1 ,, ,, ,, ,, 38th ,,
45

The period of quarantine during which the 15 cases arising therein developed was, on 4th day, 1 case; 5th day, 2 cases; 7th day, 1 case; 9th day, 2 cases; 10th day, 6 cases; 11th day, 1 case; 13th day, 1 case; 14th day, 1 case; whilst of the 4 persons who were taken ill after leaving quarantine, they sickened on 6 (?), 7, 8, and 12 days from that date respectively.

HOSPITAL QUARANTINE.

Month.	Reference to House List.	No. of Inmates.	Cases arising at Home.*	Numbers sent into Quarantine.	Attacked in Quarantine.	Day of stay in Quarantine.	Attacked after Quarantine.
Sept. 1892	3	3	No. 3	2	—	—	No. 5.—8 days after.
,, ,,	4	6	No. 6	5	No. 7	10th	
Nov. ,,	12	7	No. 23	5	—	—	No. 32.—? 6 days after.
,, ,,	14	8	No. 26	7	No. 31	11th	
Dec. ,,	19	6	No. 33	5	No. 44	10th	
					No. 59	14th	
,, ,,	22	7	Nos. 39, 43, 48	1			
	23	5	No. 40	4	No. 51	10th	No. 92.—7 days after.
					No. 52	10th	
	26	9	Nos. 45, 64	7	No. 82	4th	
					No. 85	5th	
					No. 86	5th	
Jan. 1893	32	8	Nos. 55, 90, 91, 93, 101	3			
	41	7	Nos. 72, 104	5	No. 132	9th	
	50	8	No. 88	7	No. 119	7th	
					No. 124	9th	
	59	5	No. 110	4	No. 130	13th	
Feb. ,,	67	7	No. 129	6	No. 136	10th	
	70	5	No. 135	4	—	—	No. 155.— ? 12 days after.
March ,,	77	8	Nos. 158, 165, 177	5			
April ,,	81	6	No. 163	5	No. 185	10th	
,, ,,	83	7	Nos. 165, 173, 174, 179, 190.	1			
,, ,,	85	5	Nos. 167, 169, 170	2			
May ,,	109	8	Nos. 213, 238	1			
	19 houses	125	36	79	15	—	4

Of the 36 cases arising "at home" 25 were "initial," 11 "later" cases.

In the analysis of the facts regarding the incidence of small-pox upon the 193 households under review—it will be more appropriate to separate them into two main groups—differing slightly from those above given, according as to whether or not cases occurred in the house after an interval sufficient to justify the inference that the later arising cases may have acquired the disease from the initial case. It must, of course, be conceded that such a division is somewhat arbitrary and hypothetical, but in the main it is likely to be accurate; and may enable some useful comparisons to be made.

Group I.—This group comprises all those households in which there is no sufficient evidence that any secondary infection arose in the house from the first to be attacked. It will include the 127 houses in which a single case of small-pox only occurred, and six in which there was more than one case.

Group II.—This group comprises those households in which there is every probability that the cases arising subsequently to the first infected by it.* It will include 60 households.

—	Group I. (133 Households.)	Group II. (60 Households.)	
		Initial.	Later.
Attacked with small-pox -	141	66	113
Not attacked - - -	701	213	
Total - - -	842	392	

These groups may be again sub-divided, as before, into series A and B, according as to whether the "initial" case was removed to hospital or remained at home. The latter series (B) contains all those cases which were not notified, and which passed unrecognised, until the subsequent illness of other members of the household led to their discovery.

—	Group I.		Group II.	
	Series A.	Series B.	Series A.	Series B.
Attacked - -	134	7	{Initial - 50 {Later - 67	16 37
Not attacked -	676	34	165	48
	801	41	291	101

---

* There is only one exception to this where apparently re-infection of a household occurred, viz.:—No. 149

The attack rates in each series are therefore :—

Group I. (all cases) - - -	17·9 per cent.
A. Initial case removed - -	16·7 ,,
A. ,, ,, remained - -	17· ,,
Group II. (later cases only, exclusive of initial cases) - - -	34·3 ,,
A. Initial case removed - -	31·5 ,,
B. ,, ,, remained - -	43·5 ,,

The tables already given (XXIII. and XXIV.) which showed the age-distribution and state as to vaccination of the inmates of houses yielding single and multiple cases respectively, require but slight modification to be adapted to the two groups here dealt with, owing to the transference to Group I. of six households in which more than one case occurred. The annexed Tables XXV. and XXVI. give the modified statistics, which are utilised in the subsequent analysis.

Table XXV.

Group I. (133 houses).

Houses with single cases, 127 ; with multiple cases, 6.

—	Attacked.			Not Attacked.					All Inmates.				
	Vaccinated.	Under Vaccination.	Unvaccinated.	Vaccinated.	No Information.	Under Vaccination.	Unvaccinated.		Vaccinated.	No Information.	Under Vaccination.	Unvaccinated.	
							Vaccinated on Removal of Case.	Remained.				Vaccinated on Removal of Case.	Remained.
Under 1 year	—	—	3	1	—	—	—	16	1	—	—	—	19
1 to 5 years	—	—	5	12	—	1	7	52	12	—	1	7	57
5 to 10 ,,	—	—	20	53	—	—	10	47	53	—		10	67
10 to 15 ,,	5	—	9	77	—	2	2	16	82	—	2	2	25
15 to 20 ,,	11	1	4	79	—	1	2	7	90	—	2	2	11
20 to 30 ,,	43	—	7	114	—	—	—	2	157	—	—	—	9
30 to 40 ,,	21	—	—	58	—	—	—	4	79	—	—	—	4
40 to 50 ,,	7	—	2	73	4	—	—	2	80	4	—	—	4
50 to 60 ,,	3	—	—	37	1	—	—	—	40	1	—	—	—
60 to 70 ,,	—	—	—	10	—	—	—	—	10	—	—	—	—
70 and over	—	—	—	2	—	—	—	—	2	—	—	—	—
Age not ascertained.	—	—	—	9	—	—	—	—	9	—	—	—	—
	90	1	50	525	5	4	21	146	615	5	5	21	196

Table XXVI.

Group II. (60 houses).

—	Attacked.			Not Attacked.			All Inmates.		
	Vaccinated.	Under Vaccination.	Unvaccinated.	Vaccinated.	Under Vaccination.	Unvaccinated.	Vaccinated.	Under Vaccination.	Unvaccinated.
Under 1 year -	—	1	3	—	1	8	—	2	11
1 to 5 years -	—	1	25	—	1	22	—	2	47
5 to 10 ,, -	2	1	41	10	4	14	12	5	55
10 to 15 ,, -	4	—	18	26	2	10	30	2	28
15 to 20 ,, -	13	—	4	20	1	4	33	1	8
20 to 30 ,, -	28	—	4	18	—	—	46	—	4
30 to 40 ,, -	19	—	1	32	—	—	51	—	1
40 to 50 ,, -	10	—	—	28	—	—	38	—	—
50 to 60 ,, -	3	—	—	6	—	—	9	—	—
60 to 70 ,, -	1	—	—	4	—	—	5	—	—
70 and over -	—	—	—	2	—	—	2	—	—
	89	3	96	146	9	58	226	12	154

The above data are diagrammatically illustrated in Charts VI. and VII., which show the relative incidence of the disease in each vaccination class and at each age-period. Thus, of the 1,234 persons, 320 of whom were attacked with small-pox, 841 were vaccinated, of whom 170 were attacked, a rate of 20·2 per cent. ; whereas 371 were unvaccinated, of whom 146 were attacked, a rate of 39·2 per cent.

Of the *vaccinated*, at ages 0 to 10 years, 78, of whom 2 attacked ; a rate of 2·5 per cent.

10 to 30 years, 438, of whom 104 attacked ; a rate of 23·7 per cent.

30 years and over, 316, of whom 64 attacked ; a rate of 20·2 per cent.

And of the *unvaccinated*, at ages 0 to 10 years, 273 of whom 97 attacked ; a rate of 35·5 per cent.

At ages 10 to 30 years, 88, of whom 45 attacked ; a rate of 51·5 per cent.

At ages 30 years and over, 10, of whom 4 attacked ; a rate of 40 per cent.

These figures require to be slightly modified by the inclusion of reference to these who are stated to have had small-pox prior to this outbreak. There were in all 19 such persons,* 12 of whom were vaccinated, and none of whom suffered from small-pox on this occasion. Eliminating, the rate amongst the vaccinated would be raised to 20·5 per cent and amongst the unvaccinated to 39·8 per cent.; and as they all were individuals above the age of 30 years, the attack rates in this age-period would be raised to vaccinated, 21·5 per cent. unvaccinated, 80 per cent.

It will also be seen (Table XXVII.) that of 115 persons known to have been re-vaccinated, 6 were attacked with small-pox—a rate of 5·2 per cent. The dates of their re-vaccination were from 2 to 30 years previously.

In the remaining tables which have been compiled, the general statistics are sub-divided first, amongst the Groups I and II., already defined, and secondly, with reference to the fact whether in each group the initial cases arising in the houses were removed to hospital (A) or remained at home (B.)

Table XXVII.

Vaccination Data of Members of 193 Invaded Households.

—	Attacked.	Not attacked.	—
Vaccinated - - - -	170	671	841
Re-vaccinated - - -	6	109	—
Previous small-pox - - -	—	12	—
Under Vaccination - - -	4	13	17
No information - - -	—	5	5
Previous small-pox - - -	—	2	—
Unvaccinated { Vaccinated on removal of case.	—	21 } 225	371
Unvaccinated { Remained unvaccinated.	146	204	
Previous small-pox - - -	—	5	—
	320	914	1,234

Separating these into the two groups above defined, it is seen (Table XXVIII.) that in *Group I.*, *i.e.*, households in which no case occurred subsequent to the first attacked, the incidence on the *vaccinated* members was 14·6 per cent. ; on the *unvaccinated* 23·0 per cent. If those who had previously had small-pox be subtracted, these rates would be 14·7 per cent. and 23·5 per cent. respectively.

In Group II. where cases arose subsequent to the "initial" ones, the incidence of the *later* arising cases, amongst the *vaccinated* members, was 25·8 per cent. (or 27 per cent. if those previously having had small-pox be excluded) ; and amongst the *unvaccinated* members it was 46·4 per cent.

But if all the cases (initial and later) be reckoned, the rates of incidence in Group II. amount to 35·4 per cent. for the vaccinated, and 62·3 per cent. for the unvaccinated class.

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* I have not included case No. 60 who was apparently re-infected (*v. ante*). If this case was reckoned it would raise the total numbers to 240 and 321 respectively—as there were five other inmates of her house who would have to be reckoned twice over.

TABLE XXVIII.

—	Group I.			Group II.				—
	133 Households.			60 Households.				
	Attacked.	Not Attacked.	Total.	Attacked.		Not attacked.	Total.	
				Initial.	Later.			
Vaccinated	90	525	615	29	51	146	226	841
Re-vaccinated	1	83	—	1	4	26	—	—
Previous small-pox	—	4	—	—	—	8	—	—
Under vaccination	1	4	5	—	3	9	12	17
No information	—	5	5	—	—	—	—	5
Previous small-pox	—	2	—	—	—	—	—	—
Unvaccinated :—								
Vaccinated on removal of case.	—	21	217	37	59	58	154	371
Remained unvaccinated.	50	146						
Previous small-pox	—	5	—	—	—	—	—	—
	141	701	842	63	113	213	392	1,234

In Tables XXIX. and XXX. the same figures as these given in Table XXVIII. are distributed amongst four age-periods, so that it is possible to calculate the incidence of the disease, *i.e.*, the attack-rates amongst the vaccinated and unvaccinated members of each of those communities at different periods of life.

Thus, in Group I., it will be seen that *under the age of one year* there was one *vaccinated* infant who did not have the disease; and 19 *unvaccinated*, three of whom were attacked, *i.e.*, an incidence of 15·8 per cent. (*nearly*). At age one to ten years there were 65 children who were *vaccinated*, none of whom were attacked by small-pox; and 141 *unvaccinated* of whom 25 were attacked, an incidence of 17·7 per cent. At ages 10 to 30 years the *vaccinated* were 329 in in number, and 59 were attacked, an incidence of 18·1 per cent; the *unvaccinated* were 45, of whom 20 were attacked, an incidence of 44·4 per cent. Lastly, at ages 30 years and over, of 211 who were *vaccinated*, 31 were attacked, an incidence of 14·6 per cent. (or nearly 15 per cent., if those who previously had had small-pox be subtracted); and of eight who were *unvaccinated*, two were attacked, an incidence of 25·0 per cent. (which is raised to 66·6 per cent. if those who previously had had small-pox be subtracted).

The rates are, of course, larger in Group II., where the number of cases is proportionately higher. Thus, taking all the cases (Table XXX.), it is seen that under one year of age there were 11 *unvaccinated*, of whom three were attacked, an incidence of 27·2 per cent. At one to ten years, 12 were *vaccinated*, two attacked, an incidence of 16·6 per cent., and 102 *unvaccinated*, 66 attacked, an incidence of 64·7 per cent. At 10 to 30 years 109 were *vaccinated*, of whom 45 were attacked, an incidence of 40·7 per cent. ; 40 were *unvaccinated*, 26 attacked, an incidence of 65·0 per cent. At 30 years and over, 105 were *vaccinated*, 33 attacked, an incidence of 31·4 per cent. (raised to 34 per cent. on subtracting those who had previously had small-pox). There was one *unvaccinated* subject who was attacked.

TABLE XXIX.

GROUP I.—133 houses with 842 inmates, of whom 141 attacked.

—	Under 1 year.		1 to 10 years.		10 to 30 years.		30 years and upwards.		Age not ascertained.		All Ages.	
	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.
Vaccinated	—	1	—	65	59	270	31	180	—	9	90	525
Re-vaccinated	—	—	—	2	—	35	1	37	—	9	1	83
Previous small-pox.	—	—	—	—	—	—	—	4	—	—	—	4
No information on vaccination.	—	—	—	—	—	—	—	5	—	—	—	5
Previous small-pox.	—	—	—	—	—	—	—	2	—	—	—	2
Under vaccination.	—	—	—	1	1	3	—	—	—	—	1	4
Unvaccinated :—												
Vaccinated at once.	—	—	—	17	—	4	—	—	—	—	—	21
Not vaccinated	3	16	25	99	20	25	2	6	—	—	50	146
Previous small-pox.	—	—	—	—	—	—	—	5	—	—	—	5
	3	17	25	182	80	302	33	191	—	9	141	701

Total re-vaccinated, 84, 1 of whom attacked by small-pox.

Total who had had small-pox previously, 11.

TABLE XXX.

GROUP II.—60 houses with 392 inmates, of whom 179 attacked.

—	Under 1 year.		1 to 10 years.		10 to 30 years.		30 years and upwards.		All Ages.	
	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.
Vaccinated	—	—	2	10	45	64	33	72	80	146
Re-vaccinated	—	—	—	2	2	10	3	14	5	26
Previous small-pox	—	—	—	—	—	—	—	8	—	8
Under vaccination	1	1	2	5	—	3	—	—	3	9
Unvaccinated	3	8	66	36	26	14	1	—	96	58
	4	9	70	51	71	81	34	72	179	213

Total re-vaccinated, 31, 5 of whom attacked by small-pox.

Total who had had small-pox previously, 8.

Vaccination and Measures of Isolation.

In order to determine whether any appreciable influence was exerted upon the incidence of the disease by removal of the initial cases to hospital, the cases have been distributed into two series, some of which fall under each of the groups above considered. Series A. comprises those households from which the initial cases were removed to hospital; Series B. those in which such cases remained at home. The first group contains 1,092 members—260 of whom were attacked by small-pox; the second, 142 of whom 60 were attacked.

Explanation of Chart VII. :—

This chart is intended to illustrate the condition as to vaccination of 1,234 *members of* 193 *households invaded by small-pox. Each square represents one individual—the shaded squares being those who were attacked with small-pox, the open squares those who were not attacked. A previous attack of small-pox is indicated by the sign ⊙. The fatal cases are indicated thus +. The chart shows that of the total number—*1,234 *persons—*320 *were attacked with small-pox, of whom* 17 *died. Of these numbers there were :—*

Vaccinated, 841 *: attacked,* 170 *; not attacked,* 671 *; died,* 1.
No information as to vaccination, 5 *: none of whom were attacked.*
Under vaccination, 17 *: attacked,* 4 *; not attacked,* 13.

Unvaccinated :—

(*a.*) *Vaccinated on removal of previous case,* 21 *: none of whom attacked.*
(*b.*) *Not vaccinated,* 350 *: attacked,* 146 *; not attacked,* 204 *; died,* 16.

A previous attack of small-pox was alleged in 12 *of the vaccinated ;* 2 *of those in whom no information as to vaccination was obtained ; and in* 5 *of the unvaccinated.*

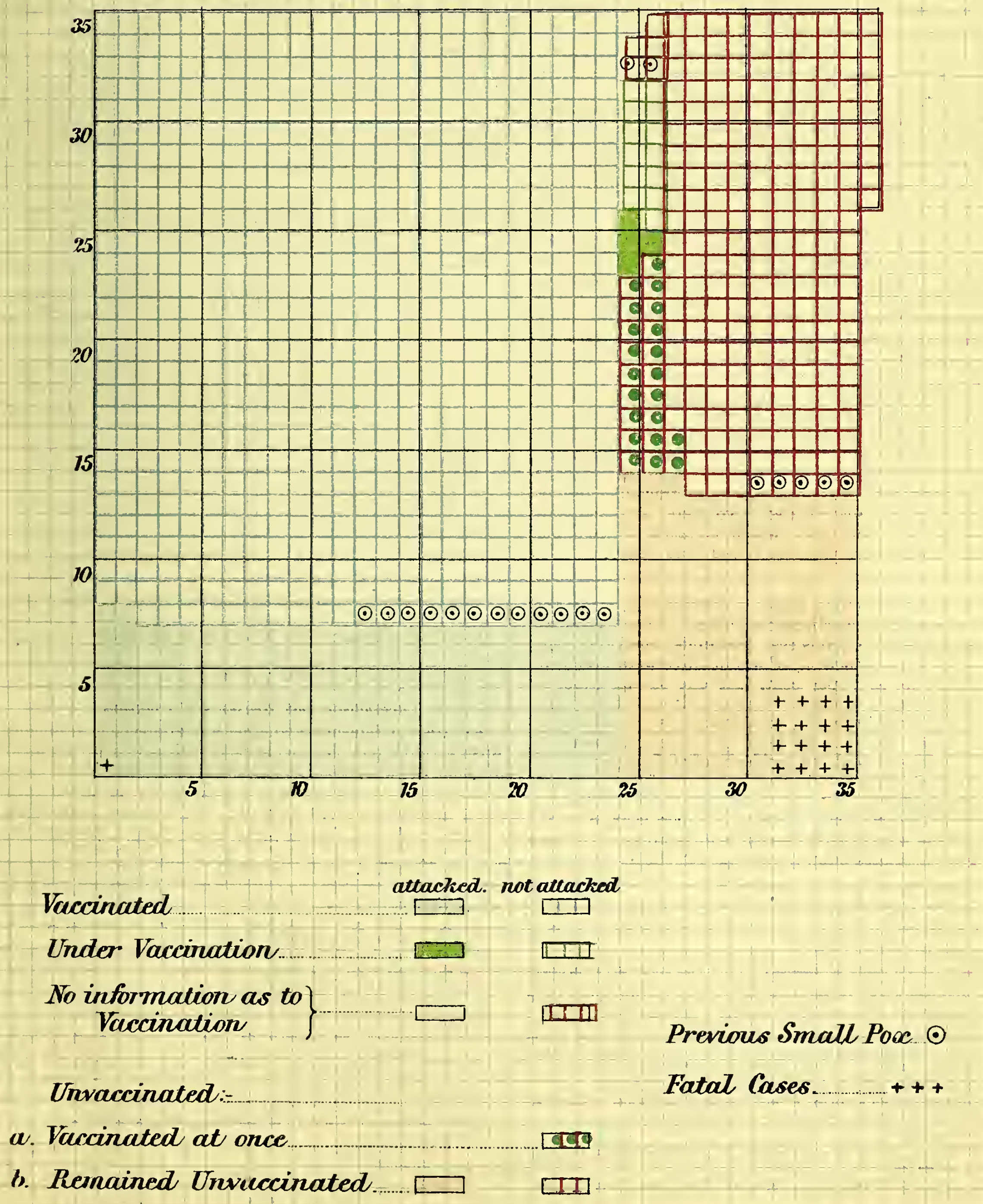
Explanation of Chart VIII. :—

This chart deals with the same statistics as Chart VI., except that the 1,234 *persons are grouped in age-periods.*

UNDER 10 YEARS OF AGE—361 *: attacked,* 102 *; not attacked,* 259.
  Vaccinated, 78 *: attacked,* 2 *; not attacked,* 76.
  Under vaccination, 10 *: attacked,* 3 *; not attacked,* 7.
Unvaccinated :—
  (*a.*) *Vaccinated on removal of case,* 17 *: none of whom were attacked.*
  (*b.*) *Not vaccinated,* 256 *; attacked,* 97 *; not attacked,* 159 *; died,* 12.
10 TO 30 YEARS—533 *: attacked,* 151 *; not attacked,* 383.
  Vaccinated, 438 *: attacked,* 104 *: not attacked,* 334.
  Under vaccination, 7 *: attacked,* 1 *; not attacked,* 6.
Unvaccinated :—
  (*a.*) *Vaccinated on removal of case,* 4 *; none of whom were attacked.*
  (*b.*) *Not vaccinated,* 84 *: attacked,* 46 *; not attacked,* 39 *; died,* 3.
30 YEARS AND OVER—331 *: attacked,* 67 *; not attacked,* 263.
  Vaccinated. 316 *: attacked,* 64 *; not attacked,* 252 *; died,* 1.
  No information on vaccination, 5 *: none attacked.*
  Unvaccinated, 10 *: attacked,* 3 *; not attacked,* 6 *; died,* 1.
AGE NOT ASCERTAINED—9.
  Vaccinated, 9 *; none attacked.*

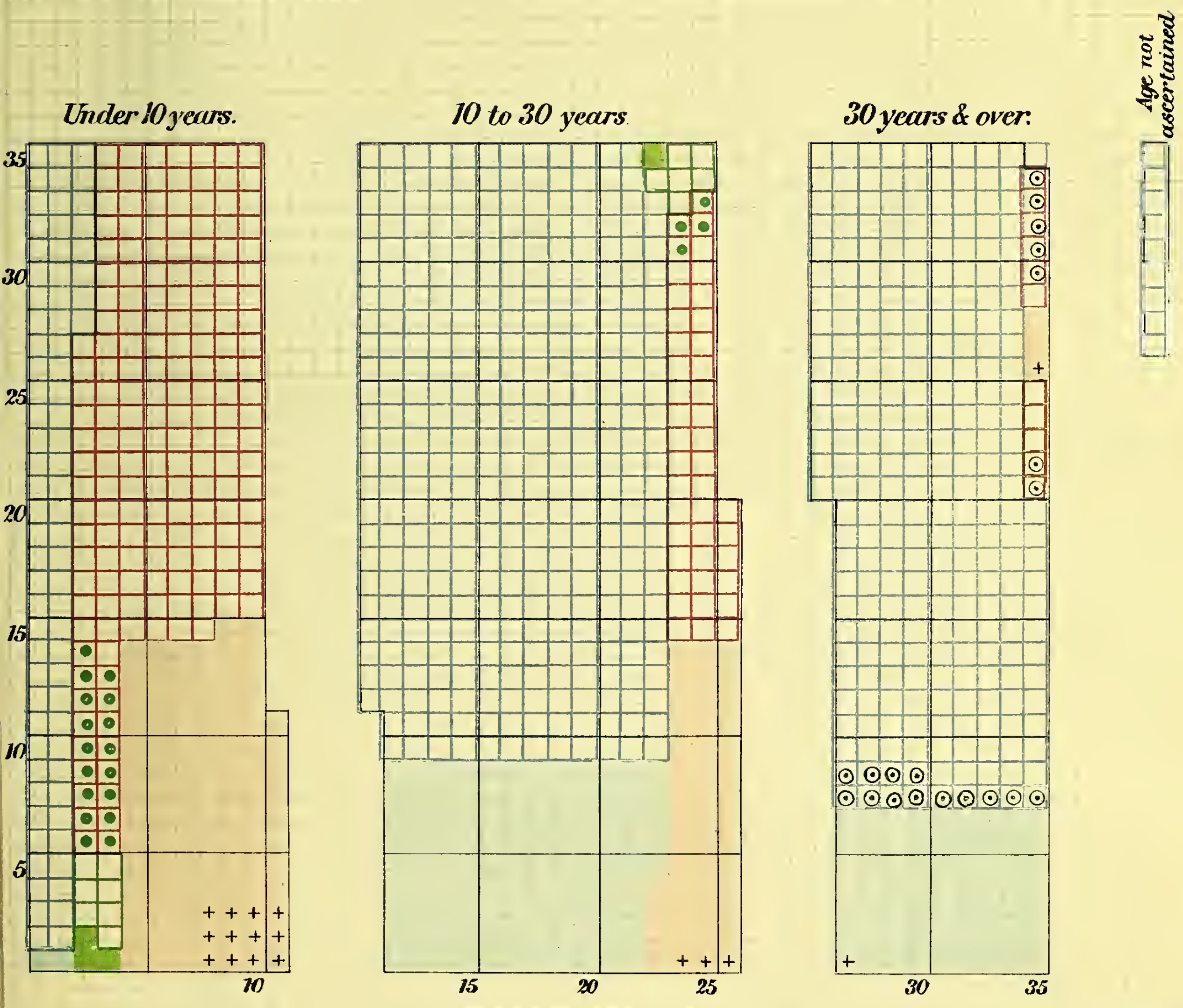
Chart VII.

VACCINATION DATA OF 1234 MEMBERS OF HOUSEHOLDS INVADED BY SMALL POX.



To face page 62 i.

VACCINATION DATA OF 1234 MEMBERS OF HOUSEHOLDS, INVADED BY SMALL POX, ARRANGED IN 3 AGE PERIODS.



For key see Chart VII; facing page 62.

TABLE XXXI.
ISOLATION AND VACCINATION.

—	Series A.		Series B.		Total.		—
	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	
Vaccinated - -	133	599	37	72	170	671	841
Re-vaccinated - -	5	89	1	20	6	109	—
Previous small-pox -	—	12	—	—	—	12	—
Under vaccination -	4	13	—	—	4	13	17
No information on vaccination - - -	—	5	—	—	—	5	5
Previous small-pox -	—	2	—	—	—	2	—
Unvaccinated:—							
Vaccinated on removal of case - - -	—	19	—	2	—	21	371
Not vaccinated - -	123	196	23	8	146	204	
Previous small-pox -	—	5	—	—	—	5	—
	260	832	60	82	320	914	1,234
Re-vaccinated - -	5	89	1	20	6	109	115
Previous small-pox -	—	19	—	—	—	19	19

It will be seen that the attack-rate or incidence for the *vaccinated* class is in Series A., 18 · 1 per cent.; in Series B., 34 per cent.; that for the *unvaccinated* class is, in Series A., 36 · 4 per cent.; in Series B., 74 · 2 per cent.; showing the far greater proportion who suffered amongst those when the initial cases remained at home.

TABLE XXXII.
INITIAL CASES REMOVED TO HOSPITAL (SERIES A.).

—	Group I.			Group II.				
	126 Households.			45 Households.				
	Attacked.	Not Attacked.	Total.	Initial.	Later.	Not Attacked.	Total.	—
Vaccinated -	85	494	579	15	33	105	153	732
Re-vaccinated -	1	71	—	1	3	18	—	—
Previous small-pox.	—	4	—	—	—	8	—	—
Under vaccination	1	4	5	—	3	9	12	17
No information -	—	5	5	—	—	—	—	5
Previous small-pox.	—	2	—	—	—	—	—	—
Unvaccinated:—								
Vaccinated on removal of case.	—	19	212	35	40	51	126	319
Remained unvaccinated.	48	145						
Previous small-pox.	—	5	—	—	—	—	—	—
	134	467	801	50	76	165	291	1,092

TABLE XXXIII.
INITIAL CASES REMAINED AT HOME (SERIES B.).

—	Group I.			Group II.				
	7 Households.			15 Households.				
	Attacked.	Not Attacked.	Total.	Initial.	Later.	Not Attacked.	Total.	—
Vaccinated -	5	31	36	14	18	41	73	110
Re-vaccination	—	12	—	—	1	8	—	—
Under vaccination	—	—	—	—	—	—	—	—
Unvaccinated:—								
Vaccinated at once.	—	2	2	—	—	—	—	—
Remained unvaccinated.	2	1	3	2	19	7	28	30
	7	34	41	16	37	48	101	142

In Tables XXXII. and XXXIII. these series have been apportioned in each of the two main groups, so as to afford comparison between those households in which the cases remained at home, or were removed, in respect to the liability to cases subsequently arising in the house. The main fact has already been dwelt on in dealing with single and multiple cases, but the respective incidence in the vaccinated and unvaccinated may here be added, in the following tabular statement:—

INCIDENCE of SMALL-POX on the VACCINATED and UNVACCINATED MEMBERS of HOUSEHOLDS.

Series A. (171 *Households*).

—	Vaccinated Rate.	Unvaccinated Rate.
Group I. (126 households) - -	14·6 per cent.	22·6 per cent.
Group II. (45 households), all cases -	31·3 „	59·5 „
„ „ later cases only.	23·9 „	43·9 „

Series B. (22 *Households*).

—	Vaccinated Rate.	Unvaccinated Rate.
Group I. (7 households) - -	13·5 per cent.	66·6 per cent.
Group II. (15 households), all cases -	43·8 „	75·0 „
„ „ later cases only.	30·5 „	73·3 „

Lastly, in Tables XXXIV. to XXXVII., these series are sub-divided amongst age-periods, but the numbers in Series B. are too small to afford any just basis of comparison in this respect, and I may, therefore, leave them without further comment.

TABLE XXXIV.
GROUP I. SERIES A.—INITIAL CASES REMOVED TO HOSPITAL.

(126 households, 801 members, 134 attacked.)

—	Under 1 year.		1 to 10 years.		10 to 30 years.		30 years and upwards.		Age not ascertained.		All Ages.	
	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not attacked.
Vaccinated -	—	1	—	64	56	248	29	172	—	9	85	494
Re-vaccinated	—	—	—	2	—	27	1	33	—	9	1	71
Previous small-pox.	—	—	—	—	—	—	—	4	—	—	—	4
No information on vaccination.	—	—	—	—	—	—	—	5	—	—	—	5
Previous small-pox.	—	—	—	—	—	—	—	2	—	—	—	2
Under vaccination.	—	—	—	1	1	3	—	—	—	—	1	4
Unvaccinated: Vaccinated at once.	—	—	—	15	—	4	—	—	—	—	—	19
Not vaccinated	2	16	25	99	19	24	2	6	—	—	48	145
Previous small-pox.	—	—	—	—	—	—	—	5	—	—	—	5
	2	17	25	179	76	279	31	183	—	9	134	667

Re-vaccinated, 72. (One attacked with small-pox.)
Previous small-pox, 11.

TABLE XXXV.
GROUP I. SERIES B.—INITIAL CASES REMAINED AT HOME.

(7 households, 41 members, 7 attacked.)

—	Under 1 year.		1 to 10 years.		10 to 30 years.		30 years and upwards.		All Ages.	
	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.
Vaccinated - -	—	—	—	1	3	22	2	8	5	31
Re-vaccinated -	—	—	—	—	—	8	—	4	—	12
Unvaccinated: Vaccinated at once -	—	—	—	2	—	—	—	—	—	2
Not vaccinated -	1	—	—	—	1	1	—	—	2	1
	1	—	—	3	4	23	2	8	7	34

Re-vaccinated, 12.

Table XXXVI.

Group II. Series A.—Initial Cases removed to Hospital.

(45 households; 291 members; 126 attacked.)

—	Under 1 Year.		1 to 10 Years.		10 to 30 Years.		30 Years up-wards.		All Ages.	
	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.
Vaccinated - - -	—	—	1	8	22	36	25	61	47	105
Re-vaccinated - -	—	—	—	—	1	6	3	12	4	18
Previous small-pox -	—	—	—	—	—	—	—	8	—	8
Under vaccination -	1	1	2	5	—	3	—	—	8	9
Unvaccinated - -	3	5	46	32	25	14	1	—	76	51
	4	6	49	45	47	53	26	61	126	165

Re-vaccinated, 28 (4 attacked with small-pox).
Previous small-pox, 8.

Table XXXVII.

Group II. Series B.—Initial Cases remained at Home.

(15 households; 101 members; 53 attacked.

—	Under 1 Year.		1 to 10 Years.		10 to 30 Years.		30 Years up wards.		All Ages.	
	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.	Attacked.	Not Attacked.
Vaccinated - - -	—	—	1	2	23	28	8	11	32	41
Re-vaccinated - -	—	—	—	2	1	4	—	2	1	8
Under vaccination -	—	—	—	—	—	—	—	—	—	—
Unvaccinated - -	—	3	20	4	1	—	—	—	21	7
	—	3	21	6	24	28	8	11	53	48

Re-vaccinated, 9 (1 attacked with small-pox).

INCIDENCE of SMALL-POX on the VACCINATED and UNVACCINATED INMATES of 193 INVADED HOUSES.

From the particulars already furnished, it is possible to calculate the rates of incidence of small-pox upon the vaccinated and unvaccinated members of households, and to contrast these rates with the rates of proportion between the two classes of all members irrespective of age. Thus we have the following data:—(1) the number of invaded households, (2) the sizes of these households, (3) the number attacked in each, (4) the number of persons who were known to have been vaccinated, and of those who were known to be unvaccinated, as well as the number of those in each class who were attacked with the disease.

It will further be of interest to contrast in these particulars the houses of various size, and for this purpose we may divide them into two groups, namely, those having six inmates or less, and those having more than six inmates.

1. In 193 houses, having 1,234 inmates, there were 320 attacked with small-pox, an incidence rate of 259 per 1,000.

2. Of these 1,234 persons, 841 were vaccinated, a proportion of 681 per 1,000; 371 were unvaccinated, a proportion of 300 per 1,000.

3. Of the *vaccinated*, 170 were attacked with small-pox, an incidence rate of 202 per 1,000. Of the *unvaccinated*, 146 were attacked, an incidence rate of 393 per 1,000.

Houses with Six Inmates or less.

1. In 109 houses, having 500 inmates, 160 were attacked with small-pox, an incidence rate of 320 per 1,000.

2. Of these 500 persons, 354 were vaccinated, a proportion of 708 per 1,000. 140 were unvaccinated, a proportion of 280 per 1,000.

3. Of the *vaccinated*, 95 were attacked with small-pox, an incidence rate of 268 per 1,000. Of the *unvaccinated*, 63 were attacked an incidence rate of 450 per 1,000.

Houses with more than Six Inmates.

1. In 84 houses, having 734 inmates, 160 were attacked with small-pox, an incidence rate of 218 per 1,000.

2. Of these 734 persons, 487 were vaccinated, a proportion of 663 per 1,000. 231 were unvaccinated, a proportion of 314 per 1,000.

3. Of the *vaccinated*, 75 were attacked with small-pox, an incidence rate of 154 per 1,000. Of the *unvaccinated*, 83 were attacked, an incidence rate of 359 per 1,000.

It may be of interest to compare the small-pox incidence in relation to the proportion of vaccinated and unvaccinated persons in these households, where (*a*) every one attacked was vaccinated, (*b*) every one attacked was unvaccinated, and (*c*) where those attacked included some vaccinated and some unvaccinated. We have thus three groups:—

Group A.—Houses in which all attacked with small-pox were *vaccinated*. This group comprises 91 houses.

Group B.—Houses in which all attacked with small-pox were *unvaccinated*. This group comprises 61 houses.

Group C.—Houses in which those attacked with small-pox were, some of them *vaccinated* and some *unvaccinated*. This group comprises 41 houses.

Group A.

1. In 91 houses, having 557 inmates, 109 were attacked with small-pox, an incidence rate of 195 per 1,000.

2. Of these 557 persons, 478 were vaccinated, a proportion of 858 per 1,000; 75 were unvaccinated, a proportion of 132 per 1,000.

3. Of the *vaccinated*, 109 were attacked with small-pox, an incidence rate of 228 per 1,000.

Houses with Six Inmates or less.

1. In 59 houses, having 258 inmates, 70 were attacked with small-pox, an incidence rate of 271 per 1,000.

2. Of these 258 persons, 221 were vaccinated, a proportion of 139 per 1,000; 36 were unvaccinated, a proportion of 139 per 1,000.

3. Of the *vaccinated*, 70 were attacked with small-pox, an incidence rate or 317 per 1,000.

Houses with more than Six Inmates.

1. In 32 houses, having 299 inmates, 39 were attacked with small-pox, an incidence rate of 130 per 1,000.

2. Of these 299 persons, 257 were vaccinated, a proportion of 859 per 1,000; 39 were unvaccinated, a proportion of 130 per 1,000.

3. Of the *vaccinated*, 39 were attacked with small-pox, an incidence rate of 155 per 1,000.

Group B.

1. In 61 houses, having 403 inmates, 86 were attacked with small-pox, an incidence rate of 213 per 1,000.

2. Of these 403 persons, 199 were vaccinated, a proportion of 493 per 1,000; 199 were unvaccinated, a proportion of 493 per 1,000.

3. Of the *unvaccinated*, 86 were attacked with small-pox, an incidence rate of 432 per 1,000.

Houses with Six Inmates or less.

1. In 30 houses, having 141 inmates, 37 were attacked with small-pox, an incidence rate of 262 per 1,000.

2. Of these 141 persons, 76 were vaccinated, a proportion of 539 per 1,000; 64 were unvaccinated, a proportion of 454 per 1,000.

3. Of the *unvaccinated*, 37 were attacked with small-pox, an incidence rate of 578 per 1,000.

Houses with more than Six Inmates.

1. In 31 houses, having 262 inmates, 49 were attacked with small-pox, an incidence rate of 187 per 1,000.

2. Of these 262 persons, 123 were vaccinated, a proportion of 469 per 1,000; 135 were unvaccinated, a proportion of 515 per 1,000.

3. Of the *unvaccinated*, 49 were attacked with small-pox, an incidence rate of 363 per 1,000.

Group C.

1. In 41 houses, having 274 inmates, 125 were attacked with small-pox, an incidence rate of 456 per 1,000.
2. Of these 274 persons, 164 were vaccinated, a proportion of 598 per 1,000; 97 were unvaccinated, a proportion of 354 per 1,000.
3. Of the *vaccinated,* 61 were attacked with small-pox, an incidence rate of 372 per 1,000; of the *unvaccinated,* 60 were attacked, an incidence rate of 618 per 1,000.

Houses with Six Inmates or less.

1. In 20 houses having 101 inmates, 53 were attacked with small-pox, an incidence rate of 524 per 1,000.
2. Of these 101 persons, 57 were vaccinated, a proportion of 564 per 1,000; 40 were unvaccinated, a proportion of 396 per 1,000.
3. Of the *vaccinated,* 25 were attacked with small-pox, an incidence rate of 438 per 1,000; of the *unvaccinated,* 26 were attacked, an incidence rate of 650 per 1,000.

Houses with more than Six Inmates.

1. In 21 houses, having 173 inmates, 72 were attacked with small-pox, an incidence rate of 416 per 1,000.
2. Of these 173 persons, 107 were vaccinated, a proportion of 618 per 1,000; 57 were unvaccinated, a proportion of 330 per 1,000.
3. Of the *vaccinated,* 36 were attacked with small-pox, an incidence rate of 336 per 1,000; of the *unvaccinated,* 34 were attacked, an incidence rate of 596 per 1,000.

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§ 15. *Supplementary Note.*

It may be of interest to contrast in a few particulars the experience of this outbreak of small-pox at Leicester, with that previously reported on at the Dewsbury Union, in 1891 to 1892. The following statistics show the chief points of comparison to which attention may be drawn.

COMPARISON of SMALL-POX STATISTICS.

—	LEICESTER, 1892–93.	DEWSBURY UNION, 1891–92.
Number of Cases -	357	1,029
Males - -	181	521
Females - -	176	508
Death-rate - -	21 or 5·8 per cent.	110 or 10·7 per cent.

Age-Periods.	Cases.	Per cent.	Deaths.	Fatality.	Cases.	Per cent.	Deaths.	Fatality.
				%				%
Under 1 year -	7	1·9	2	28·6	29	2·8	19	65·5
1 to 10 years -	102	28·5	13	12·7	195	18·9	38	19·4
10 to 30 „ -	161	45·1	3	3·4	560	54·4	33	5·9
30 and over -	87	24·3	3	3·4	238	23·1	20	8·4
Age not ascertained	—	—	—	—	7	0·6	—	—
	357	—	21	—	1,029	—	110	—

RELATIVE MORTALITY at DIFFERENT AGES.

Under 1 year -	9·5 per cent.	17·2 per cent.
1 to 10 years -	61·9 „	34·5 „
10 to 30 „ -	14·3 „	30·0 „
30 and over -	14·3 „	18·1 „

STATISTICS of the UNVACCINATED.

Total Unvaccinated	154 or 43·1 per cent.	346 or 33·6 per cent.
Deaths - -	19 or 12·4 „	89 or 25·7 „

Age Periods.	No. Attacked.	Proportion of all Cases.	Proportion of all Unvaccinated.	No. Attacked.	Proportion of all Cases.	Proportion of all Unvaccinated.
		%	%		%	%
Under 1 year -	6	85·6	3·2	21	72·4	6·0
1 to 10 years -	98	96·1	64·7	137	70·2	39·6
10 to 30 „ -	46	28·5	29·4	165	29·4	47·7
30 and over -	4	4·6	2·6	22	9·2	6·3
Age not ascertained	—	—	—	1	—	0·3
	153	—	—	346	—	—

STATISTICS of SMALL-POX in INVADED HOUSES of which particulars obtained).

—	LEICESTER.	DEWSBURY UNION.
Invaded Houses -	193	544
Total Inmates -	1,234	3,000
Attacked with Small-pox.	329 or 25·9 per cent.	887 or 29·5 per cent.

At Ages.	Attacked.	Not Attacked.	Rate.	Attacked.	Not Attacked.	Rate.
			%			%
Under 1 year. -	7	26	21·2	25	50	33·3
1 to 10 years -	95	233	28·9	178	476	27·2
10 to 30 „ -	151	383	28·2	482	867	35·7
30 and over -	67	268	20·3	202	699	32·3
Age not ascertained	—	9	—	—	21	—
	320	914	—	887	2,113	—

Single cases in -	127 Houses.	355 Houses.
Total Inmates -	795	1,840
Attacked with Small-pox.	127 or 16 per cent.	355 or 19·2 per cent.
Multiple cases in -	66 Houses.	189 Houses.
Total Inmates -	439	1,160
Attacked with Small-pox.	193 or 44 per cent.	532 or 45·8 per cent.

PROPORTIONS of the UNVACCINATED in above HOUSEHOLDS.

—	Attacked.	Not Attacked.	Attacked.	Not Attacked.
All Classes - -	320	914	887	2,113
Unvaccinated -	146	225	294	233
Proportion of Unvaccinated.	45·6 p.c.	24·5 p.c.	33·1 p.c.	11·0 p.c.
Attack Rate among Unvaccinated.	39·3 per cent.		55·7 per cent.	
Exclusive of those who had had Small-pox previously.	146	220	293	186
Ditto.	40·0 per cent.		61·1 per cent.	

SMALL-POX INCIDENCE ON VACCINATED AND UNVACCINATED.

—	LEICESTER.			DEWSBURY UNION.		
	Houses with Six Inmates or less.	Houses with more than Six Inmates.	All Houses.	Houses with Six Inmates or less.	Houses with more than Six Inmates.	All Houses.
Number of Houses	109	84	193	384	160	544
Inmates—total	500	734	1,234	1,682	1,318	3,000
Vaccinated	354	487	841	1,247	1,024	2,271
Do. per 1,000	708	663	681	741	769	757
Unvaccinated	140	231	371	314	213	527
Do. per 1,000	280	314	300	186	161	175
Attacked—total	160	160	320	554	333	887
Incidence per 1,000	320	218	259	329	252	295
Vaccinated	95	75	170	344	200	544
Incidence per 1,000	268	154	202	275	195	239
Unvaccinated	63	83	146	180	114	294
Incidence per 1,000	450	359	393	573	535	557

GROUP A.—*All attacked were vaccinated (or 'under' or 'alleged').*

Number of Houses	59	32	91	235	89	324
Inmates—total	258	299	557	983	746	1,729
Vaccinated	221	257	478	841	672	1,513
Do. per 1,000	856	859	858	855	900	875
Unvaccinated	36	39	75	66	38	104
Do. per 1,000	139	130	132	67	51	60
Attacked—total	70	39	109	297	144	441
Incidence per 1,000	271	130	195	302	193	255
Vaccinated	70	39	109	273	136	409
Incidence per 1,000	317	155	228	324	202	270
Unvaccinated	—	—	—	—	—	—
Incidence per 1,000	—	—	—	—	—	—

GROUP B.—*All attacked were unvaccinated.*

—	LEICESTER.			DEWSBURY UNION.		
	Houses with Six Inmates or less.	Houses with more than Six Inmates.	All Houses.	Houses with Six Inmates.	Houses with more than Six Inmates.	All Houses.
Number of Houses	30	31	61	99	34	133
Inmates—total	141	262	403	459	272	731
Vaccinated	76	123	199	258	163	421
Do. per 1,000	539	469	493	562	599	575
Unvaccinated	64	135	199	167	94	261
Do. per 1,000	454	515	493	363	345	357
Attacked—total	37	49	86	116	52	168
Incidence per 1,000	262	187	213	252	191	229
Vaccinated	—	—	—	—	—	—
Incidence per 1,000	—	—	—	—	—	—
Unvaccinated	37	49	86	115	50	165
Incidence per 1,000	578	363	432	688	532	632

GROUP C.—*Attacked were vaccinated and unvaccinated.*

Number of Houses	20	21	41	50	37	87
Inmates—total	101	173	274	240	300	540
Vaccinated	57	107	164	148	189	337
Do. per 1,000	564	618	598	616	630	624
Unvaccinated	40	57	97	81	81	162
Do. per 1,000	396	330	354	337	270	300
Attacked—total	53	72	125	141	137	278
Incidence per 1,000	524	416	456	587	456	514
Vaccinated	25	36	61	71	64	135
Incidence per 1,000	438	336	372	480	338	400
Unvaccinated	26	34	60	65	64	129
Incidence per 1,000	650	596	618	802	790	796

SIDNEY COUPLAND, M.D.

MAP OF LEICESTER SHOWING HOUSES INVADED BY SMALL POX 1892-93.

PARISH OF LEICESTER FRITH
LEICESTER FRITH
GILROES FARM
PARISH OF GILROES
GILROES
BIRDS NEST FARM
BEAUMONT
PARISH OF LEICESTER ABBEY
St Johns Stone REMAINS OF
Old Sewage Pumping Station
Sewage Pumping Station
OLD BRIDGE
BELGRAVE COTTON MILLS
BELGRAVE
BELGRAVE MILL
POLICE OFFICE
HIGH MERES
MIDLAND
WHITE HOUSE
NORTHFIELD HOUSE
BELGRAVE ROAD GROUNDS
ALLOTMENT GARDENS
RED HOUSE FARM
Viaduct
HUMBERSTONE HOUSE
BOROUGH LUNATIC ASYLUM
PARISH OF HUMBERSTONE
HUMBERSTONE LODGE
THE GRANGE
Chapel
THE COTTAGE
THE HALL
PHŒNIX IRON WORKS
HUMBERSTONE BRICK & TILE WORKS
VICTORIA NURSERY
NEW HUMBERSTONE
HUMBERSTONE STATION
SCRAPTOFT ROAD
MEADOW HOUSE
UPPINGHAM ROAD
St Barnabas's Ch.
LEICESER ABBEY REMAINS OF
ABBEY PARK
THE PASTURE
BATHS
GREAT NORTHERN STATION
RECREATION GROUND
ENGINE SHED
FOREST ROAD
NEW PARK HOUSE
NEW PARKS
FEVER HOSPITAL
FREAKES GROUND PARISH
NEWFOUND POOL PARISH
NEW PARK FARM
ASHLEIGH HOUSE
DANE HILLS
WYGGESTON HOSPITAL
LEICESTER & BURTON BRANCH MIDLAND RAILWAY
RAILWAY WHARF
HUMBERSTONE ROAD STATION
NEW EVINGTON
G. N. R. (LEICESTER BRANCH)
SPINNEY HILL PARK
HIGHFIELDS
PARISH OF EVINGTON
EVINGTON LODGE
EVINGTON LANE
EVINGTON PARKS
UNION
STATION
GOODS STATION
Market Place
St Marys Ch.
NEWARK ST
GAOL
INFIRMARY
RECREATION GROUND
South Fields
PAVILION
CRICKET GROUND
VICTORIA PARK
CEMETERY
CATTLE MARKET
LEICESTERSHIRE & RUTLAND LUNATIC ASYLUM
LEICESTERSHIRE & NORTHAMPTONSHIRE UNION CANAL
Lock
FREEMANS WEIR
WESTCOTES FARM
BRAUNSTONE PARK
BRAUNSTONE HOUSE
RED HOUSE FARM
St Peters Ch.
BRAUNSTONE
OLD HALL FARM
PARISH OF BRAUNSTONE
NEW FIELDS
St MARYS MILLS
AYLESTONE ROAD GAS WORKS
FREEMEN'S COMMON
CLARENDON PARK
Knighton Brick
ASHFIELD
BROOKFIELD
THE HOLT
THE SHRUBBERY
STONELEIGH
THE HOLME
KNIGHTON FRITH
STONEYGATE HOUSE
STONEYGATE
THE LODGE
LYNWOOD
ALLAN DALE
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